THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellant(s):	Singh, B., et al.
Appl. No.:	09/881,935
Conf. No.:	8096
Filed:	June 15, 2001
Title:	METHOD AND APPARATUS FOR CUSTOMIZING A MULTIPLE COMPONENT PET FOOD
Art Unit:	1764
Examiner:	Bhat, Nina Nmn
Docket No.:	115808-459

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P.O. Box 1450
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APPELLANTS' APPEAL BRIEF

Sir:

Appellants submit this Appeal Brief in support of the Notice of Appeal filed on March 21, 2007. This Appeal is taken from the Final Rejection in the Office Action dated November 21, 2006.

I. REAL PARTY IN INTEREST

The real party in interest for the above-identified patent application on Appeal is Nestec, S.A. by virtue of an Assignment dated January 17, 2003 and recorded at reel 013366, frame 0316 in the United States Patent and Trademark Office.

II. RELATED APPEALS AND INTERFERENCES

Appellants' legal representative and the Assignee of the above-identified patent application do not know of any prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision with respect to the above-identified Appeal.

III. STATUS OF CLAIMS

Claims 1-28 are pending in this application. Claims 1-28 stand rejected. Therefore, Claims 1-28 are being appealed in this Brief. A copy of the appealed claims is included in the Claims Appendix.

IV. STATUS OF AMENDMENTS

A final Office Action was mailed on November 21, 2006. Appellants filed a response to the final Office Action on February 2, 2007 with no amendments to the claims. An Advisory Action was mailed on March 21, 2007. In the Advisory Action, the response was considered but the Examiner maintained the previous rejection. Appellants filed a Notice of Appeal on March 21, 2007. A copy of the final Office Action and the Advisory Action are attached as Exhibit A and Exhibit B, respectively, in the Evidence Appendix.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A summary of the invention by way of reference to the specification and/or figures for each of the independent claims is provided as follows:

Independent Claim 1 is directed to a method for suggesting a pet food for a pet (page 1, par. 3; Figures 2-3), said method comprising obtaining an individual pet profile for the pet (page 1, par. 3; page 3, par. 12-13; Figures 2-3), processing the individual pet profile (page 1, par. 3; page 4, par. 14-15; Figures 2-3), suggesting a pre-manufactured kibble that correlates with the processed pet profile (page 1, par. 3; Figures 2-3), suggesting a pre-manufactured additive that correlates with the processed pet profile (page 1, par. 3; Figures 2-3), obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive (pages 5-6, par. 16-17; Figures 2-3), suggesting a second pre-manufactured kibble and a second pre-manufactured additive that is based on the biological sample analysis and the individual pet profile, and providing a set of feeding instructions for the pet (page 1, par. 3; page 6, par. 18-19; pages 10-11, par. 33-35; pages 11-12, par. 36-37; Figures 2-3).

Independent Claim 4 is directed to a method for customizing a pet food for a pet (page 2, par 4; Figures 2-3), said method comprising obtaining an individual pet profile for the pet (page 2, par 4; page 3, par. 12-13; Figures 2-3), processing the individual pet profile to create a pet food additive formula (page 2, par 4; page 4, par. 14-15; Figures 2-3), suggesting a pre-manufactured kibble that correlates with the processed pet profile (page 2, par 4; Figures 2-3), preparing a pet food additive derived from the created pet food additive formula (page 2, par 4; Figures 2-3), obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive (pages 5-6, par. 16-17; Figures 2-3), and preparing a second pre-manufactured kibble and a second pet food additive that is based on the biological sample analysis and the individual pet profile (page 6, par. 18-19; pages 10-11, par. 33-35; pages 11-12, par. 36-37; Figures 2-3).

Independent Claim 8 is directed to an apparatus for customizing a pet food product for a pet (page 2, par. 5; Figure 1), said apparatus comprising means for obtaining an individual pet profile for the pet (page 2, par. 5; page 4, par. 14; Figure 1), means for processing the individual pet profile (page 2, par. 5; page 4, par. 14-15; Figure 1), means for creating a pet food additive formula in accordance with the processed individual pet profile (page 2, par. 5; Figure 1), means

for suggesting a pet food kibble in accordance with the processed individual pet profile (page 2, par. 5; Figure 1), means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive (pages 5-6, par. 16-17; Figures 2-3), means for suggesting a second pre-manufactured kibble and a second pet food additive formula that is based on the biological sample analysis and the individual pet profile (page 6, par. 18-19; pages 10-11, par. 33-35; Figures 2-3), and means for producing a second pet food additive in accordance with the second pet food additive formula (page 2, par. 5; pages 11-12, par. 36-37; Figure 1).

Independent Claim 11 is directed to a method for obtaining a customized pet food product for a pet (page 2, par. 6; Figures 2-3), said method comprising providing information pertaining to an individual pet profile of the pet (page 2, par. 6; page 3, par. 12-13; Figures 2-3), obtaining a pre-manufactured kibble that correlates with the provided information (page 2, par. 6; Figures 2-3), obtaining a pet food additive derived from a pet food additive formula created utilizing the provided information (page 2, par. 6; Figures 2-3), obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive (pages 5-6, par. 16-17; Figures 2-3), and obtaining a second pre-manufactured kibble and a second pet food additive that is based on the biological sample analysis and the individual pet profile (page 6, par. 18-19; pages 10-11, par. 33-35; pages 11-12, par. 36-37; Figures 2-3).

Independent Claim 12 is directed to a method for creating a customized pet food additive formula for a pet (page 2, par 4; Figures 2-3), said method comprising receiving, through an electronic interface, a user input comprising an individual pet profile for the pet (page 4, par. 14-15), providing a first pet food formula based on the individual pet profile (page 2, par 4; Figures 2-3), receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to the first pet food formula (pages 5-6, par. 16-17; Figures 2-3), electronically processing the individual pet profile and the biological sample analysis to create a pet food additive formula utilizing information obtained from the user input individual pet profile and the biological sample analysis (page 6, par. 18-19; pages 10-11, par. 33-35; Figures 2-3), and electronically processing the individual pet profile and the biological sample analysis to suggest a pre-manufactured kibble utilizing information obtained from the user input individual pet profile and the biological sample analysis (page 6, par. 18-19; pages 10-11, par. 33-36; Figures 2-3).

Independent Claim 13 is directed to a method for supplying a pet food for a pet (page 2, par. 6; Figures 2-3), said method comprising obtaining an individual pet profile for the pet (page 3, par. 12-13), processing the individual pet profile (page 3, par. 12-13; page 4-15, par. 14), supplying a pre-manufactured kibble based on the processed individual pet profile (page 2, par 4; Figures 2-3), creating a custom pet food additive based on the processed individual pet file (page 2, par 4; page 4, par. 14-15; Figures 2-3), supplying the custom pet food additive, obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive (pages 5-6, par. 16-17; pages 10-11, par. 33-35; Figures 2-3), creating a second pre-manufactured kibble and a second custom additive that is based on the biological sample analysis and the individual pet profile (page 6, par. 18-19; Figures 2-3), and supplying the second pre-manufactured kibble and the second custom additive (page 6, par. 18-19; pages 11-12, par. 36-37; Figures 2-3).

Although specification citations are given in accordance with C.F.R. 1.192(c), these reference numerals and citations are merely examples of where support may be found in the specification for the terms used in this section of the Brief. There is no intention to suggest in any way that the terms of the claims are limited to the examples in the specification. As demonstrated by the references numerals and citations, the claims are fully supported by the specification as required by law. However, it is improper under the law to read limitations from the specification into the claims. Pointing out specification support for the claim terminology as is done here to comply with rule 1.192(c) does not in any way limit the scope of the claims to those examples from which they find support. Nor does this exercise provide a mechanism for circumventing the law precluding reading limitations into the claims from the specification. In short, the references numerals and specification citations are not to be construed as claim limitations or in any way used to limit the scope of the claims.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1-7 and 11-28 are rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 6,669,975 to Abene ("*Abene*") and U.S. Patent No. 6,280,779 to Nadeau ("*Nadeau*") further in view of U.S. Patent No. 6,042,857 to Jones et al. ("*Jones*"). Copies of *Abene*, *Nadeau* and *Jones* are attached herewith as Exhibits C, D and E, respectively, in the Evidence Appendix.

2. Claims 8-10 are rejected under 35 U.S.C. §103(a) as unpatentable over *Abene* and *Nadeau* further in view of U.S. Patent No. 5,340,211 to Pratt ("*Pratt*"). A copy of Pratt is attached herewith as Exhibit F in the Evidence Appendix.

VII. ARGUMENT

A. LEGAL STANDARDS

Obviousness under 35 U.S.C. §103

The Federal Circuit has held that the legal determination of an obviousness rejection under 35 U.S.C. § 103 is:

> whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made…The foundational facts for the prima facie case of obviousness are: (1) the scope and content of the prior art; (2) the difference between the prior art and the claimed invention; and (3) the level of ordinary skill in the art…Moreover, objective indicia such as commercial success and long felt need are relevant to the determination of obviousness…Thus, each obviousness determination rests on its own facts.

In re Mayne, 41 U.S.P.Q. 2d 1451, 1453 (Fed. Cir. 1997).

In making this determination, the Patent Office has the initial burden of proving a *prima facie* case of obviousness. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q. 2d 1955, 1956 (Fed. Cir. 1993). This burden may only be overcome "by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings." *In re Fine*, 837 F.2d 1071, 1074, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988). "If the examination at the initial stage does not produce a prima facie case of unpatentability, then without more the applicant is entitled to grant of the patent." *In re Oetiker*, 24 U.S.P.Q. 2d 1443, 1444 (Fed. Cir. 1992).

Of course, references must be considered as a whole and those portions teaching against or away from the claimed invention must be considered. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve Inc.*, 796 F.2d 443 (Fed. Cir. 1986). "A prior art reference may be considered to teach away when a person of ordinary skill, upon reading the reference would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the Applicant." *Monarch Knitting Machinery Corp. v. Fukuhara Industrial Trading Co., Ltd.*, 139 F.3d 1009 (Fed. Cir. 1998), quoting, *In re Gurley*, 27 F.3d 551 (Fed. Cir. 1994).

B. THE CLAIMED INVENTION

Independent Claim 1 is directed to a method for suggesting a pet food for a pet that method comprises obtaining an individual pet profile for the pet, processing the individual pet profile, suggesting a pre-manufactured kibble that correlates with the processed pet profile and suggesting a pre-manufactured additive that correlates with the processed pet profile. A biological sample analysis is obtained from the pet after the pet has eaten a combination of the kibble and the additive, and a second pre-manufactured kibble and a second pre-manufactured additive is suggested that is based on the biological sample analysis and the individual pet profile. A set of feeding instructions is provided for the pet.

Independent Claim 4 is directed to a method for customizing a pet food for a pet that comprises obtaining an individual pet profile for the pet, processing the individual pet profile to create a pet food additive formula, suggesting a pre-manufactured kibble that correlates with the processed pet profile and preparing a pet food additive derived from the created pet food additive formula. A biological sample analysis is obtained from the pet after the pet has eaten a combination of the kibble and the additive, and a second pre-manufactured kibble and a second pet food additive is prepared and based on the biological sample analysis and the individual pet profile.

Independent Claim 8 is directed to an apparatus for customizing a pet food product for a pet. The apparatus comprises means for obtaining an individual pet profile for the pet, means for processing the individual pet profile, means for creating a pet food additive formula in accordance with the processed individual pet profile and means for suggesting a pet food kibble in accordance with the processed individual pet profile. The apparatus further comprises means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive, means for suggesting a second pre-manufactured kibble and a second pet food additive formula that is based on the biological sample analysis and the individual pet profile and means for producing a second pet food additive in accordance with the second pet food additive formula.

Independent Claim 11 is directed to a method for obtaining a customized pet food product for a pet that comprises providing information pertaining to an individual pet profile of the pet, obtaining a pre-manufactured kibble that correlates with the provided information and obtaining a pet food additive derived from a pet food additive formula created utilizing the

provided information. A biological sample analysis is obtained from the pet after the pet has eaten a combination of the kibble and the additive, and a second pre-manufactured kibble and a second pet food additive are obtained and based on the biological sample analysis and the individual pet profile.

Independent Claim 12 is directed to a method for creating a customized pet food additive formula for a pet that comprises receiving, through an electronic interface, a user input comprising an individual pet profile for the pet, providing a first pet food formula based on the individual pet profile and receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to the first pet food formula. The individual pet profile and the biological sample analysis are electronically processed to create a pet food additive formula utilizing information obtained from the user input individual pet profile and the biological sample analysis, and the individual pet profile and the biological sample analysis are electronically processed to suggest a pre-manufactured kibble utilizing information obtained from the user input individual pet profile and the biological sample analysis.

Independent Claim 13 is directed to a method for supplying a pet food for a pet that comprises obtaining an individual pet profile for the pet, processing the individual pet profile, supplying a pre-manufactured kibble based on the processed individual pet profile, creating a custom pet food additive based on the processed individual pet file and supplying the custom pet food additive. A biological sample analysis is obtained from the pet after the pet has eaten a combination of the kibble and the additive. A second pre-manufactured kibble and a second custom additive are created and based on the biological sample analysis and the individual pet profile and supplied to the pet.

C. THE REJECTION OF CLAIMS 1-7 AND 11-28 UNDER 35 U.S.C. §103(a) SHOULD BE REVERSED BECAUSE THE EXAMINER HAS NOT ESTABLISHED A *PRIMA FACIE* CASE OF OBVIOUSNESS

Appellants respectfully submit that the cited references, alone or in combination, fail to disclose or suggest every element of independent Claims 1, 4 and 11-13. Independent Claims 1, 4, 11 and 13 recite, in part, the steps of obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive and suggesting or preparing a

second pre-manufactured kibble and a second pre-manufactured or pet food additive based on the biological sample analysis and the individual pet profile. The kibble and additive from which the biological sample analysis is obtained are derived from the processing the individual pet profile. Independent Claim 12 recites, in part, the steps of receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to the first pet food formula and creating or suggesting a pet food additive formula and a pre-manufactured kibble utilizing information obtained from the individual pet profile and biological sample analysis. Similarly, the first pet food formula is based on an individual pet profile.

An advantage of the present invention that is not disclosed or suggested by the cited references is that an analysis of the biological sample can be obtained after the pet has eaten, for a predetermined period of time, a combination of a customized pet food such as, for example, a first pre-manufactured kibble and the first custom additive produced based on individual pet profile information. The biological sample analysis can provide information that enhances or supplements the individual pet profile information and be used to further modify and refine the customized pet food product by suggesting a different pre-manufactured kibble, adding specific additive ingredients, removing specific additive ingredients, and/or changing the amount of any included additive ingredient from the pet product formulation to enable the new formulation to better meet the needs of the pet. See, specification, paragraph 16.

The biological sample analysis can provide additional information that can be useful in formulating the pet food product to meet individual pet's needs. For example, the analysis can determine a pet's individual reaction to a diet and the pet's ability to change its health status, including, but not limited to stool quality, immune status, oral/dental health, skeletal health, skin and coat health. See, specification, paragraph 17. The pet's individual reaction and ability to change may be different than a reaction of another pet in the same category to the same diet. For example, in creating pet foods for the "average" dog, digestion tests are typically conducted on a statistically large group of animals and their reactions averaged. The predictions are made on how these diets may fare for other similar dogs. Individual variations are thus excluded during creating foods for the "average" pet. It is these individual variations that can be addressed by using the claimed methods. *Id.*

Appellants respectfully submit that, even if combinable, the cited references fail to disclose or suggest a number of elements of the present claims. For example, *Abene* fails to

disclose or suggest the step of obtaining a biological sample analysis from the pet after the pet has eaten a combination of a first kibble and additive that correlates with the processed pet profile as required, in part, by Claims 1, 4, 11 and 13. *Abene* also fails to disclose or suggest the step of receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to the first pet food formula as required, in part, by Claim 12. The Examiner admits same. See, Office Action, page 3, lines 9-12. *Abene* further fails to disclose or suggest the step of obtaining or suggesting a second pre-manufactured kibble or additive based on the biological sample analysis and the individual pet profile as required, in part, by Claims 1, 4, 11 and 13. *Abene* also fails to disclose or suggest the step of creating a pet food additive formula and suggest a pre-manufactured kibble utilizing information obtained from the individual pet profile and the biological sample analysis as required, in part, by Claim 12.

Similarly, *Nadeau* fails to disclose or suggest the step of obtaining a biological sample analysis from the pet after the pet has eaten a combination of a first kibble and additive based on an individual pet profile as required, in part, by Claims 1, 4, 11 and 13. *Nadeau* also fails to disclose or suggest the step of receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to a first pet food formula based on an individual pet profile as required, in part, by Claim 12. Moreover, because *Nadeau* never discloses obtaining a biological sample analysis in the manner required by the present claims, *Nadeau* cannot provide or create a second pre-manufactured kibble and additive or additive formula based on both the biological sample analysis and individual pet profile in accordance with the present claims.

Although *Nadeau* is said to teach obtaining a biological sample analysis, the stool sample in *Nadeau* is taken after feeding a pet a general meat chunk-in-gravy pet food. See, *Nadeau*, column 4, lines 36-58. However, this meat chunk-in-gravy pet food is <u>not based on any individual profile of the pet</u>, which teaches away from the present claims. Moreover, the method in *Nadeau* recites substantially increasing stool quality in a pet which has experienced unacceptable stool quality after ingesting primarily a meat chunk and gravy diet having unacceptable stool quality. See, *Nadeau,* column 1, lines 28-55 and Claim 1. Because *Nadeau* applies to pets already experiencing a stool problem stemming from a general pet food, any stool sample taken subsequently does not disclose or suggest a biological sample analysis taken <u>after</u> the pet has eaten a kibble, additive or pet food <u>based on a pet profile</u>.

Finally, *Jones* fails to disclose or suggest the step of obtaining a biological sample analysis from the pet after the pet has eaten a combination of a first kibble and additive based on an individual pet profile as required, in part, by Claims 1, 4, 11 and 13. *Jones* also fails to disclose or suggest the step of receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to a first pet food formula based on an individual pet profile as required, in part, by Claim 12. Further, *Jones* fails to disclose or even suggest any first kibble and additive or pet food based on an individual pet profile in accordance with the present claims.

In sum, Appellants have discovered the novel way of making individual customized pet food products based on individual pet profiles and biological sample analyses. Nowhere do the cited references, alone or in combination, recognize or successfully employ every step of the claimed methods. For at least the reasons discussed above, Appellants respectfully submit that independent Claims 1, 4 and 11-13 and Claims 2-3, 5-7 and 14-28 that depend from Claims 1, 4 and 11-13 are novel, nonobvious and distinguishable from the cited references and are in condition for allowance.

D. THE REJECTION OF CLAIMS 8-10 UNDER 35 U.S.C. §103(a) SHOULD BE REVERSED BECAUSE THE EXAMINER HAS NOT ESTABLISHED A *PRIMA FACIE* CASE OF OBVIOUSNESS

Appellants respectfully submit that the cited references, alone or in combination, fail to disclose or suggest every element of independent Claim 8. Independent Claim 8 recites, in part, an apparatus comprising a means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive in accordance with a processed individual pet profile and a means for suggesting a second pre-manufactured kibble and a second pet food additive formula based on the biological sample analysis and the individual pet profile. In contrast, Appellants respectfully submit that, even if combinable, the cited references fail to a number of elements of Claim 8.

Abene fails to disclose or suggest a means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of the first kibble and additive based on an individual pet profile as required, in part, by Claim 8. The Examiner admits same. See, Office

Action, page 3, lines 9-12. Similarly, *Nadeau* fails to disclose or suggest a means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of a first kibble and additive based on an individual pet profile as required, in part, by Claim 8. Instead, the stool sample of *Nadeau* is taken after feeding a pet a general meat chunk-in-gravy pet food that is not based on any individual profile of the pet. See, *Nadeau*, column 4, lines 36-58. Because *Nadeau* applies to pets already experiencing a stool problem stemming from a general pet food, any stool sample taken subsequently does not disclose or suggest a biological sample analysis taken after the pet has eaten a kibble, additive or pet food based on a pet profile.

Abene and *Nadeau* further fail to disclose or suggest a means for suggesting a second pre-manufactured kibble or additive based on the biological sample analysis and the individual pet profile as required, in part, by Claim 8. Because *Nadeau* never discloses means for obtaining a biological sample analysis in the manner required by Claim 8, *Nadeau* does not disclose the means for obtaining a second pre-manufactured kibble and additive or additive formula based on both the biological sample analysis and individual pet profile.

Finally, *Pratt* fails to disclose or suggest a means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of the first kibble and additive based on an individual pet profile as required, in part, by Claim 8. Instead, *Pratt* is entirely directed to measuring and dispensing microingredient additives into a liquid carrier. See, *Pratt*, column 3, lines 26-31. *Pratt* further fails to even teach any first kibble and additive based on an individual pet profile or obtaining a biological sample from a pet after the pet has consumed the first kibble and additive in accordance with the present claims.

For at least the reasons discussed above, Appellants respectfully submit that independent Claim 8 and Claims 9-10 that depend from Claim 8 are novel, nonobvious and distinguishable from the cited references and are in condition for allowance.

VIII. CONCLUSION

Appellants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness under 35 U.S.C. §103 with respect to the rejections of Claims 1-28. Accordingly, Appellants respectfully submit that the obviousness rejections are erroneous in law and in fact and should therefore be reversed by this Board.

A check in the amount of $500 is submitted herewith to cover the cost of the Appeal Brief. The Director is authorized to charge any additional fees which may be required, or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 115808-459 on the account statement.

Respectfully submitted,

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BY _____

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Dated: May 21, 2007

CLAIMS APPENDIX

PENDING CLAIMS ON APPEAL OF U.S. PATENT APPLICATION SERIAL NO. 09/881,935

1. A method for suggesting a pet food for a pet, said method comprising:

obtaining an individual pet profile for the pet;

processing the individual pet profile;

suggesting a pre-manufactured kibble that correlates with the processed pet profile;

suggesting a pre-manufactured additive that correlates with the processed pet profile;

obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive;

suggesting a second pre-manufactured kibble and a second pre-manufactured additive that is based on the biological sample analysis and the individual pet profile; and

providing a set of feeding instructions for the pet.

2. A method in accordance with Claim 1 wherein providing a set of feeding instructions comprises:

providing information regarding the proper amount of additive to feed the pet; and

providing information regarding the proper amount of kibbles to feed the pet.

3. A method in accordance with Claim 2 further comprising providing information on whether additional components should be added to the pet food.

4. A method for customizing a pet food for a pet, said method comprising:

obtaining an individual pet profile for the pet;

processing the individual pet profile to create a pet food additive formula;

suggesting a pre-manufactured kibble that correlates with the processed pet profile;

preparing a pet food additive derived from the created pet food additive formula;

obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive; and

preparing a second pre-manufactured kibble and a second pet food additive that is based on the biological sample analysis and the individual pet profile.

5. A method in accordance with Claim 4 further comprising providing a set of feeding instructions for the pet.

6. A method in accordance with Claim 5 wherein providing a set of feeding instructions comprises:

providing information regarding the proper amount of additive to feed the pet; and

providing information regarding the proper amount of kibbles to feed the pet.

7. A method in accordance with Claim 6 further comprising providing information on whether additional components should be added to the pet food.

8. Apparatus for customizing a pet food product for a pet, said apparatus comprising:

means for obtaining an individual pet profile for the pet;

means for processing the individual pet profile;

means for creating a pet food additive formula in accordance with the processed individual pet profile;

means for suggesting a pet food kibble in accordance with the processed individual pet profile;

means for obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive;

means for suggesting a second pre-manufactured kibble and a second pet food additive formula that is based on the biological sample analysis and the individual pet profile; and

means for producing a second pet food additive in accordance with the second pet food additive formula.

9. Apparatus in accordance with Claim 8 wherein said means for obtaining an individual pet profile comprises receiving information from a pet profile questionnaire.

10. Apparatus in accordance with Claim 8 wherein said means for processing the individual pet profile including the information based on user input and the information obtained from the biological sample analysis of the pet comprises a computer configured to process the individual pet profile and combine the processed information with stored nutritional information to suggest a pet food product.

11. A method for obtaining a customized pet food product for a pet, said method comprising:

providing information pertaining to an individual pet profile of the pet;

obtaining a pre-manufactured kibble that correlates with the provided information;

obtaining a pet food additive derived from a pet food additive formula created utilizing the provided information;

obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive; and

obtaining a second pre-manufactured kibble and a second pet food additive that is based on the biological sample analysis and the individual pet profile.

12. A method for creating a customized pet food additive formula for a pet, said method comprising:

receiving, through an electronic interface, a user input comprising an individual pet profile for the pet;

providing a first pet food formula based on the individual pet profile;

receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to the first pet food formula;

electronically processing the individual pet profile and the biological sample analysis to create a pet food additive formula utilizing information obtained from the user input individual pet profile and the biological sample analysis; and

electronically processing the individual pet profile and the biological sample analysis to suggest a pre-manufactured kibble utilizing information obtained from the user input individual pet profile and the biological sample analysis.

13. A method for supplying a pet food for a pet, said method comprising:

obtaining an individual pet profile for the pet;

processing the individual pet profile;

supplying a pre-manufactured kibble based on the processed individual pet profile;

creating a custom pet food additive based on the processed individual pet file;

supplying the custom pet food additive;

obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive;

creating a second pre-manufactured kibble and a second custom additive that is based on the biological sample analysis and the individual pet profile; and

supplying the second pre-manufactured kibble and the second custom additive.

14. A method in accordance with Claim 13 wherein obtaining an individual pet profile comprises obtaining at least one of species, activity level, medical history, breed, gender, breeding status, feeding method, age, spayed/neutered status, snack schedule, flavor preference, body condition and weight of the pet.

15. A method in accordance with Claim 13 wherein obtaining an individual pet profile comprises obtaining answers to a plurality of questions regarding individual attributes of the pet.

16. A method in accordance with Claim 13 wherein obtaining an individual pet profile comprises obtaining answers to a plurality of questions regarding preferences of an owner of the pet.

17. A method in accordance with Claim 13 wherein creating a custom pet food additive based on the processed individual pet file comprises creating at least one of a gravy, a sauce, a coating, a thickener, a topping and a powder.

18. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding Psyllium fiber to the additive.

19. A method in accordance with Claim 18 wherein adding Psyllium fiber comprises adding between 0 and 1.0% Psyllium fiber be weight in the additive.

20. A method in accordance with Claim 18 wherein adding Psyllium fiber comprises adding a sufficient quantity of Psyllium fiber to bind water and prevent separation of aqueous and fat phases in the sauce.

21. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding a pH lowering agent to bring the pH between about 2.0 and about 3.0.

22. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding a substance to the pet food additive to provide resistance to at least one of bacterial, fungal, and other microbial spoilage.

23. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding a source of omega three fatty acids to the additive.

24. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding sodium acid pyrophosphate for dental and skeletal health to the additive.

25. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding a palatability agent to the additive.

26. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding a source of fiber to the additive.

27. A method in accordance with Claim 13 wherein creating a custom pet food additive comprises adding a source of at least one of vitamins and minerals to the additive.

28. A method in accordance with Claim 13 comprises supplying the appropriate ratio of kibbles to additive.

EVIDENCE APPENDIX

EXHIBIT A: Final Office Action dated November 21, 2006

EXHIBIT B: Advisory Action dated March 21, 2007

EXHIBIT C: U.S. Patent No. 6,669,975 to Abene ("*Abene*"), cited by the Examiner in the Office Action dated November 21, 2006

EXHIBIT D: U.S. Patent No. 6,280,779 to Nadeau ("*Nadeau*"), cited by the Examiner in the Office Action dated November 21, 2006

EXHIBIT E: U.S. Patent No. 6,042,857 to Jones et al. ("*Jones*"), cited by the Examiner in the Office Action dated November 21, 2006

EXHIBIT F: U.S. Patent No. 5,340,211 to Pratt ("*Pratt*"), cited by the Examiner in the Office Action dated November 21, 2006

EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/881,935	06/15/2001	Bhajmohan (Ricky) Singh	115808-459	8096

29157 7590 11/21/2006

BELL, BOYD & LLOYD LLC
P. O. BOX 1135
CHICAGO, IL 60690-1135

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BELL, BOYD & LLOYD
INTELLECTUAL PROPERTY DOCKET
NOV 27 2006
ATTY RMB-MYB
DOCKET # 115808-459 Due: 2-21-07

EXAMINER	
BHAT, NINA	
ART UNIT	PAPER NUMBER
1764	

DATE MAILED: 11/21/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/881,935	SINGH ET AL.	
	Examiner	Art Unit	
	N. Bhat	1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 September 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's arguments of September 15, 2006 has been fully and carefully considered and applicant's arguments are not persuasive for reasons of record in the office action of June 22, 2006 and the following:

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-7 and 11-28 remain rejected under 35 U.S.C. 103(a) as being unpatentable over Abene et al. [USP 6,669,975] in combination with Nadeau[USP 6,280,779] further in view of Jones et al.[USP 6,042,857].

Abene et al. teach the invention substantially as claimed. Abene et al. teach collecting information relating to certain attributes and physical conditions of a pet form pet profile, analyzing the information from the pet profile to form a dietary health management system.[See Column 3, last paragraph] Mixtures of selected functional ingredients can be added to a pre-made dry kibble specifically pointed out in Column 3, line 18 and Column 4, lines 55-57] Abene et al. teach providing specific feeding instructions for the pet based on the additives and kibble which was formulated based on the pet profile information. With respect to claim 12, wherein the pet profile is inputted through an electronic interface, Abene et al. teach that the appropriate formulation for customized dry kibble production and the addition of pet food products can be determined manually from the pet profile or alternatively a software program that will convert the

information into an appropriate formulation for the customized dry kibble and will determine the proper wet food, for complete diet health management has been contemplated and there has been suggested in Abene et al. to use a WINDOWS based software system that accepts manual input about the general health conditions of an animal and can be run on a desktop computer. Abene further recites coating the volume of dry kibble pieces with a mixture of functional ingredients to coat the kibble and specifically teaches coating with safflower oil, fax seed oil, vitamin E oil.[Note Example 1 and Column 32, lines 45-54] The types of pet profiling information which is to be gathered in formulating the pet food has been taught in Table 2.

However, Abene et al. does not teach obtaining a biological sample analysis from the pet after the pet has eaten a combination of the kibble and the additive; suggesting a second premanufactured kibble and a second premanufactured additive that is based on the biological sample analysis and the individual pet profile.

Nadeau et al. specifically teaches providing a pet food composition which includes meat chunks and gravy wherein stool samples from the pet is analyzed after pet food has been eaten, and then the pet food is adjusted based on the stool sample results. Specifically, Pet Foods X, Y, and Z are prepared with ingredients as set forth in Tables I-III. Nadeau et al. teach that in a series of separate seven day feed tests, ten adult beagle dogs were feed only Pet Foods X, Y, and Z. The dogs were permitted 45 minutes to consume the food, the feces eliminated by each do were evaluated daily and graded based on the condition of the fecal matter as set forth in Column 6, lines 44-60. The same experiment was conducted using 5 commercial meat foods and the stools were evaluated. Nadeau et al. teach that the dog food formulations particularly the thickening agents used in the gravies can be adjusted based on the stool quality and the food can be changed to provide improved dietary health of the pet.

Jones et al. teach providing a pet food, which is microbially stable and has an increased shelf life, freshness, palatability and n nutritional value added pet food. The ingredients include high fibers such as oats, flax seed meal and psyllium to produce a diet high in soluble fiber.[Note Column 3, lines 55 to Column 4, line 29]. Jones et al. teach that the psyllium is added in order to bind the water, which renders the water unavailable for microbial growth and oxidation. Jones et al. also teach that providing a prolonged shelf life pet food and products include combinations of preservatives and/or antimyotics and to include high levels of sugars, edible organic acids and inorganic acids to maintain pH and to manipulate the amount of acid to provide a pH in the range of 2 or 3 would have been obvious to one having ordinary skill in the art. [Note Column 4, lines 63-67] The amount of edible soluble fiber is above 3% as taught by Jones et al., which is higher than what is claimed by applicant but to reduce the amount or to modify the amount of psyllium added would have been obvious to one having ordinary skill in the art because the art recognizes that the amount of soluble fiber does bind water and modify the amount based on how much water binding is required for achieving dietary health benefits has been taught by Abene et al and Nadeau et al.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a method for suggest a pet food for a pet from the combined teachings or Abene et al. who teaches specifically the concept obtaining a pet profile, processing the individual pet profile either manually or using a software package which correlates a premanufactured kibble which correlates with the processed pet profile and further can include additional ingredients such as additives which would be beneficial to the pet based on the individual pet profile. The concept of actually correlating the pet food after consumption with the pet's biological sample and analyzing the food and suggesting a different type of food based on the analysis has been generically taught by Nadeau et al. Jones et al. teaches

applicant's specific type of fibers and additives and it is maintained that applicant's invention as a whole has been fairly taught and suggested by the prior art.

5. Claims 8-10 remain rejected under 35 U.S.C. 103(a) as being unpatentable over Abene et al. in combination with Nadeau and Pratt.

Abene et al. in combination with Nadeau teach the invention substantially as claimed for reason delineated above.

However Abene et al. or Nadeau do not specifically teach using computer-controlled apparatus for administering pet food.

Pratt teaches a method and apparatus whereby livestock and poultry are administered feed additives in their feed ration. The apparatus includes a programmable control, which dispenses and weighs feed additives into the feed ration for poultry and livestock. [Note Figure 1 and Claims 20-27]

It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a method for suggest a pet food for a pet from the combined teachings or Abene et al. who teaches specifically the concept obtaining a pet profile, processing the individual pet profile either manually or using a software package which correlates a premanufactured kibble which correlates with the processed pet profile and further can include additional ingredients such as additives which would be beneficial to the pet based on the individual pet profile. The concept of actually correlating the pet food after consumption with the pet's biological sample and analyzing the food and suggesting a different type of food based on the analysis has been generically taught by Nadeau et al. Pratt teaches an apparatus which is capable of customizing a pet food product for a pet which includes means for obtaining an individual pet profile and means for processing the individual pet profile (note the computer in Figure 1) and means for creating a pet food additive, means for analyzing a biological sample

(in Pratt weight is measured), there are means for adding additives to feed rations. It is maintained that applicant's invention as a whole has been fairly taught and suggested by the prior art.

6. Applicant has argued that the cited references do not disclose or suggest all the claimed elements, Abene does not disclose or suggest obtaining a biological sample analysis from the pet after the pet has eaten a combining of a first kibble and additive based on a individual pet profile as required, Abene does not teach receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to the first pet food formula. Nadeau and Jones fail to disclose receiving an analysis from a biological sample of the pet after the pet has been eating a pet food manufactured according to a first pet food formula based on an individual pet profile. Applicant is arguing each reference singularly applicant is reminded that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It is maintained that the combined teachings of *Abene, Nadeau* and *Jones* does suggest to one having ordinary skill in the art to use an individual pet profile in order to include additives to a pre-made kibble based on an individual pet profile, the deficiencies in Abene, i.e., taking a biological sample after the pet consumes the food and the addition of the psyllium amount, and providing an apparatus which is capable of taking a pre-made kibble and then coating with additives based on an individual pet profile has been taught in the secondary references of Nadeau, Jones and Pratt. It is maintained that combined teachings of *Abene, Nadeau, Jones and Pratt* as set forth in the rejection above renders applicant's claims as a whole obvious to one having ordinary skill in the art at the time the invention was made.

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Bhat whose telephone number is 571-272-1397. The examiner can normally be reached on Monday-Friday, 9:30AM-6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NINA BHAT
PRIMARY EXAMINER
~~GROUP 1300~~
TC 1700

EXHIBIT B

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/881,935	06/15/2001	Bhajmohan (Ricky) Singh	115808-459	8096

29157 7590 03/13/2007

BELL, BOYD & LLOYD LLP
P.O. Box 1135
CHICAGO, IL 60690

EXAMINER	
BHAT, NINA NMN	
ART UNIT	**PAPER NUMBER**
1764	
MAIL DATE	**DELIVERY MODE**
03/13/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

RECEIVED
BELL, BOYD & LLOYD
INTELLECTUAL PROPERTY DOCKET
MAR 19 2007
ATTY: bmb-MWB
DOCKET #: 115808
459

Advisory Action Before the Filing of an Appeal Brief	Application No.	Applicant(s)	
	09/881,935	SINGH ET AL.	
	Examiner	Art Unit	
	N. Bhat	1764	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 02 February 2007 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☐ For purposes of appeal, the proposed amendment(s): a) ☐ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: _____.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

N. Bhat
Primary Examiner
Art Unit: 1764

Continuation of 11. does NOT place the application in condition for allowance because: Applicant maintains that the references do not teach making a pre-manufactured food based on a pet profile which is adjusted after biological samples are taken after the pet consumes the food product. Admittedly it is not taught in a single reference, the rejection is based on a combination of references and applicant is arguing the references for what has been taught individually not what the combined teaching of the references would suggest to one having ordinary skill in the art. It is maintained that the combined teachings of Abene et al, Nadeau et al. and Jones et al. would teach and suggest a method of making a pet food which includes the steps of processing an individual pet profile, suggesting a premanufacture kibble that correlates with the processed pet profile, suggesting additives that correlates witht heprocessed pet frofile, obtaining a sample analysis from the pet after the pet has eaten a combination of kibble and additivek, and suggesting a second pre-maufacture kibble and second premanufactured additive that is based on the biological sample analysis and the indivdual pet profile and provdiing a set of feeding instructions for the pet which has been set forth in the FINAL rejection..

EXHIBIT C

US006669975B1

(12) **United States Patent**
Abene et al.

(10) **Patent No.: US 6,669,975 B1**
(45) **Date of Patent: Dec. 30, 2003**

(54) **CUSTOMIZED DIETARY HEALTH MAINTENANCE SYSTEM FOR PETS**

(75) Inventors: **Thomas G. Abene**, Los Alamitos, CA (US); **Michael J. Wilson**, Rossmoor, CA (US); **Stefano E. Zancan**, Auckland (NZ)

(73) Assignee: **Mars Incorporated**, McLean, VA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/498,240**

(22) Filed: **Feb. 3, 2000**

(51) **Int. Cl.**[7] **A23K 1/00**

(52) **U.S. Cl.** **426/302**; 426/2; 426/232; 426/805; 426/635

(58) **Field of Search** 426/232, 2, 302, 426/805, 635

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,705,695	A	12/1972	Sandor	241/34
4,022,915	A	5/1977	Zukerman	426/72
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5,299,529	A	4/1994	Ramirez	119/51.1
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5,851,573	A *	12/1998	Lepine et al.	426/74
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6,254,920	B1 *	7/2001	Brunner	426/656
6,358,546	B1	3/2002	Bebiak et al.	426/232
2001/0043983	A1 *	11/2001	Hamilton	426/635

OTHER PUBLICATIONS

'Royal Canin RCCI Size', internet pages from http://www-.labrador.cz/royalpes.htm., pp. 1–4, 1997.*

* cited by examiner

Primary Examiner—Chhaya Sayala
(74) *Attorney, Agent, or Firm*—Fulbright & Jaworski L.L.P.

(57) **ABSTRACT**

The subject invention is directed to a customized dietary health management system for pets. The pet food diet provides the required level of nutrients and it includes a customized pet food product formulated from a dry pet food kibble recipe and selected functional additives. The formulation of the dry pet food kibble is selected on the basis of an individual pet's attributes and physical conditions. The diet further includes a selected wet pet food, functional snacks and treats, and health accessories packaged with specific feeding instructions for the pet. The dietary health management system raises the level of nutrients for a companion animal from an adequate level to an optimal level, thereby enhancing the health and happiness of the companion animal.

10 Claims, 2 Drawing Sheets

PERFECT FIT By WALTHAM

Special Blend for:
Tessa

This PERFECT FIT by WALTHAM dry diet was developed for Tessa with information that was provided by her veterinarian, Dr. Jones. This dry product is a medium protein recipe made with real chicken as the first ingredient. Highly digestible carbohydrates are used and the product has a special blend of fibers for digestive health. This product is also fortified with essential fatty acids, vitamins and minerals to ensure Tessa keeps her healthy skin and coat. To help with Tessa's joint problems, this product is fortified with glucosamine and condroitant sulfates in conjunction with gamma linoleic acid (GLA).

We have also delivered 2 cases of WALTHAM Adult canned food for dogs products and WALTHAM Tartar Chew. Our Tartar Chew is clinically proved to reduce tartar and plaque build up.

If you have any questions regarding our food or feeding instructions please contact us immediately.

Product Custom Made 15 January 2000 Best Used By 15 April 2000

Guaranteed Analysis		Ingredients:
Crude Protein	25% min.	Chicken, Chicken Meal, Canola Meal, Rice, Barley, Oats,
Crude Fat	12% min.	Tallow (preserved with mixed tocopherls), Chicken Digest,
Crude Fiber	6% max.	Tomato & Grape Meals, Flax Seed Meal, Sunflower Oil,
Moisture	10% max.	Flax Seed Oil, Borage Oil, Fish Oil, Seatone, Vitamins &
Kcal/ 100grams	310	Minerals.
Days of Supply*	34	This product has been formulated to meet AAFCO
Cups per Pound	8	Nutritional guidelines for a dog of any lifestage.

*Based on mixed feeding regiment

Feeding Guidelines

These guidelines assume that Tessa's weight of 50 lbs. is to be maintained. Remember these are only guidelines and adjustment may be necessary.

We recommend feeding twice a day. This will help Tessa absorb more of the nutrients and place less stress on her digestive system.

FOOD	Dry Food Only	Once per Day	Twice per Day Per serving
Custom Diet Dry	4 1/2 cups	4 cups	2 cups
Can Large		1 can	1/2 can
Tartar Chew		1 serving	1 serving in evening

Net Weight 35 lbs. **Customer # 8875** **Dry Food for Dogs**

FIG. 1

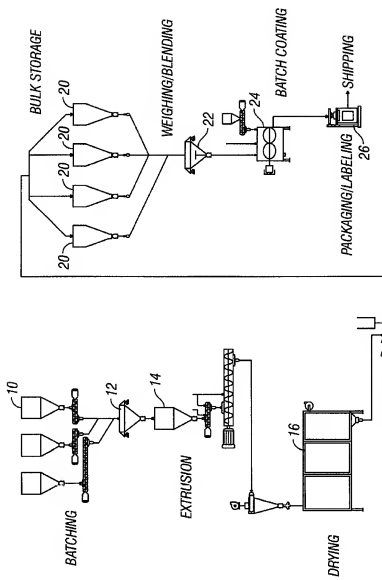
BULK STORAGE
20
20
20
20
20
WEIGHING/BLENDING
22
24
BATCH COATING
SHIPPING
26
PACKAGING/LABELING
18
COMTINUOUS COATING
16
DRYING
14
EXTRUSION
12
10
BATCHING

FIG. 2

CUSTOMIZED DIETARY HEALTH MAINTENANCE SYSTEM FOR PETS

FIELD OF THE INVENTION

This invention generally relates to a customized dietary health management system for pets and more particularly to a customized pet food diet selected on the basis of a pet's attributes and nutritional needs, wherein the diet includes a customized dry pet food kibble and selected wet pet food, functional snacks and treats, and health accessories packaged with specific feeding instructions for the pet.

BACKGROUND OF THE INVENTION

People have become increasingly aware of the importance of a proper diet for the health maintenance and disease prevention of their pets. Customized diets for various life stages and conditions have long been available for humans, but have not been available for companion animals as almost all pet food is a mass produced, off the shelf product.

There are a variety of commonly known pet food products available to pet owners. The selection of cat and dog food includes, as an example, wet pet foods, semi-moist pet foods, dry pet foods and pet treats. Wet pet food generally has a moisture content above 65%. Semi-moist pet food typically has a moisture content between 20–65% and can include humectants such as propylene, glycol, potassium sorbate, and other ingredients to prevent microbial growth (bacteria and mold). Dry pet food (kibble) generally has a moisture content below 20% and its processing typically includes extruding, drying and/or baking in heat. Pet treats can typically be semi-moist, chewable treats; dry treats in any number of forms; chewable bones or baked, extruded or stamped treats; confection treats or other kinds of treats as is known to one skilled in the art. Pet health accessories can include flea collars, tooth brushes, shampoos, DENTA-BONE® or other kinds of pet health accessories as is know to one skilled in the art.

As an example, the ingredients of a dry pet food generally include cereal, grains, meats, poultry, fats, vitamins, and minerals. The ingredients are mixed and put through an extruder/cooker. Thereafter, the product is cutter-shaped and dried. After drying, flavors, and fats can be coated or sprayed onto the dry product.

All pet food is required to provide a certain level of nutrients. As an example, nutrient profiles for both dog and cat foods, based on commonly-used ingredients, have been established by the Association of American Feed Control Officials (AAFCO) and the Pet Food Institute. These established profiles are called the "AAFCO dog food nutrient profiles" and the "AAFCO cat food nutrient profiles." AAFCO has established these profiles and regulations in order to assure that pet food is nutritionally adequate. Under these regulations, dog and cat foods for designated life stage(s) must be formulated to contain concentrations of nutrients that meet all minimum levels and not to exceed the maximum levels as determined by AAFCO. These profiles are designed to establish practical minimum and maximum nutrient levels for dog and cat foods, formulated from non-purified, complex ingredients.

AAFCO has established minimum and some maximum levels for two categories of pet food: growth and reproduction (gestation/lactation), and maintenance. As an example, Table 1 below illustrates the nutrient profiles for dog foods as determined by AAFCO. The nutrient levels are expressed

on a dry matter basis at a defined caloric density, which for dogs is 3.5 kcal ME/g dry matter.

TABLE 1

AAFCO DOG FOOD NUTRIENT PROFILES

Nutrient	Units DM Basis	Growth & Repro Minimum	Adult Maint Minimum	Maximum
Protein	%	22.0	18.0	
Arginine	%	0.62	0.51	
Histidine	%	0.22	0.18	
Isoleucine	%	0.45	0.37	
Leucine	%	0.72	0 59	
Protein	%	22.0	18.0	
Lysine	%	0.77	0.63	
Methionine-cystine	%	0.53	0.43	
Phenylalanine-tyrosine	%	0.89	0.73	
Threonine	%	0.58	0.48	
Tryptophan	%	0.20	0.16	
Valine	%	0.48	0.39	
Fat	%	8.0	5.0	
Linoleic acid	%	1.0	1.0	
Minerals				
Calcium	%	1.0	0.6	2.5
Phosphorus	%	0.8	0.5	1.6
Ca:P ratio	%	1:1	1:1	
Potassium	%	0.6	0.6	
Sodium	%	0.3	0.06	
Chloride	%	0.45	0.09	
Magnesium	%	0.04	0.04	0.3
Iron	mg/kg	80	80	3000
Copper	mg/kg	7.3	7.3	250
Zinc	mg/kg	120	120	1000
Iodine	mg/kg	1.5	1.5	50
Selenium	mg/kg	0.11	0.11	2
Vitamins & Others				
Vitamin A	IU/kg	5000	5000	250000
Vitamin D	IU/kg	500	500	5000
Vitamin E	IU/kg	50	50	1000
Thiamine	mg/kg	1.0	1.0	
Riboflavin	mg/kg	1.0	1.0	
Pantothenic Acid	mg/kg	10	10	
Niacin	mg/kg	11.4	11.4	
Pyridoxine	mg/kg	1.0	1.0	
Folic Acid	mg/kg	0.18	0.18	
Vitamin B_{12}	mg/kg	0.022	0.022	
Choline	mg/kg	1200	1200	

The AAFCO nutritional guideline provides adequate nutrition but may not provide the animal with optimal nutrition. In addition to providing a nutritionally proper diet for the health maintenance of pets, it is also important to provide companion animals with a diet that includes disease prevention benefits. The effects of certain dietary additives for disease prevention such as joint health, gut health, and skin and coat health has been extensively reported in the literature. Certain of these dietary additives are selectively available in individual off-the-shelf pet food products in the form of supplements or other nutrition enhancers. Pet food products are also available for certain life stages of animals, such as puppies, gestation/lactation, and senior pets. However, there remains a need in the art for customized diets and customized dietary health management systems for pets that are selected on the basis of a pet's attributes and nutritional needs. There is also a need in the art for a customized dietary health management system that includes a customized dry kibble product and selected wet pet food, functional snacks and treats, and health accessories necessary to balance out the nutritional needs, all packaged with specific feeding instructions for the pet.

SUMMARY OF THE INVENTION

The subject invention is directed to a customized dietary health management system for pets. The pet food diet provides the required level of nutrients and it includes a customized pet food product formulated from a dry pet food kibble recipe and selected functional additives. The formulation of the dry pet food kibble is selected on the basis of an individual pet's attributes and physical conditions as determined by the pet's owner, veterinarian or other animal specialist. The diet further includes a selected wet pet food, functional snacks and treats, and health accessories packaged with specific feeding instructions for the pet. The subject invention is also directed to a method of manufacturing a customized dry pet food product that includes the steps of: selecting at least one formulation of pre-made dry kibble; separating a predetermined volume of the at least one formulation of the pre-made dry kibble; blending the predetermined volume of dry kibble; coating the volume of dry kibble with a selected mixture of functional ingredients; and packaging and labeling the predetermined volume of coated dry kibble. The selection of the at least one formulation of the pre-made dry kibble and the mixture of functional ingredients is based on an individual pet's attributes and physical conditions in order to provide a customized dry pet food product.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more apparent when the detailed description of exemplary embodiments is considered in conjunction with the appended drawings, in which:

FIG. 1 is an illustration of a product label with feeding instructions for the dietary health management system; and

FIG. 2 is a flow diagram of a precess for manufacturing and blending the customized dry pet food product of the subject invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The subject invention provides a customized dietary health management system for pets that includes a method of providing a unique dry food product coupled with wet food, functional snacks and treats, and health accessories that are selected on the basis of the nutritional needs of the companion animal. The customized dietary health management system is formulated from information, provided by the owner of the pet, the pet's veterinarian or animal health care provider that relates to certain attributes and physical conditions of the pet. This information is collected on a pet profile form completed by the pet owner or veterinarian. The information from the pet profile is then analyzed and a customized diet and health management system is formulated. The dietary health management system customizes the essential and nonessential nutrients for a companion animal from an adequate level, based on the needs of the average companion animal, to an individual diet designed to optimize the health of a specific companion animal. The individual diet is based on that animal's life stage, activity level and other health related imputs. An example of the kind of information requested on a pet profile is illustrated below in Table 2.

TABLE 2

Size of dog when fully grown Check one box in puppy	2–15 lb.	15–25 lb.	25–50 lb.	50–75 lb.	75–100 lb.	100+
Date of Birth						
Sex	Male	Female		Comments		
Fixed	Yes	No				
Nursing	Yes	No				
Pregnant	Yes	No				
Coat Type	Short	Long				
Itchy/Scratchy Skin	Normal	Excessive				
Pet Sleeps/Lives	Indoors	Outdoors				
Weight lb.	2–15 lb.	15 to 25 lb.	25 to 50 lb.	75 to 100 lb.		100+
Current Activity Level	Sporting	Active	Moderate	Sedentary		
Feeding Preference	Meat	Dry	Snacks	Table Scraps		All
Time of Feeding	Morning	Afternoon	Night			
Known Food Allergies						
General Condition	Healthy	Average	Needs Improving		Comments	
Teeth						
Gums						
Breath						
Joint Health						
Weight						
GI Track						
Urinary Health						
Skin & Coat						
Stool Quality						
Additional Facts Regarding Pets Health or Nutritional Needs						

The customized diet and dietary health management system is adjusted for the parameters listed above, such as a dog's size, age and sex, which will control the amount of protein and caloric needs of the companion animal. The diet can be customized to provide health benefits for weight loss, joint health, digestive health, skin and coat health, wound healing, puppy health, senior pet health, immune system enhancement, life enhancement and other animal related issues. For example, the diets can be fortified with essential fatty acids, vitamins and minerals to ensure a healthy skin and coat. Anti-oxidant compounds may be added to raise the level of anti-oxidants in the companion animal's blood and fructooligosaccharides, which help good bacteria in the digestive tract, may be added to help improve nutrient absorption for good digestive health.

Mixtures of selected functional ingredients, or functional cocktails, can be added to the dry kibble pet food in order to provide a number of different health benefits. By example only, a functional cocktail for weight loss can include flaxseed oil, corrugated linoleic acid and chicory; a functional cocktail for skin and coat health can include sunflower oil, flaxseed oil, and vitamin E; a functional cocktail for Joint health can include borage oil, flaxseed oil and green lip mussel extract; a functional cocktail for digestive health can include flaxseed oil, vitamin E, fluctooligosaccharide and chicory; a functional cocktail for puppies can include flaxseed oil, sunflower oil, chicory and flaxseed and fish oil, and a functional cocktail for a senior diet can include flaxseed

oil, vitamin E, sunflower oil, natural flavor, fructooligosaccharides and chicory. Other ingredients can include vitamin C, SAMME, Gamma linoenic acid, evening primerose oil, soy isoflavones, creatine, herbs, fructo oligosaccharides, mannan oligosaccharides, polyphenols, caroteniods and other supplements.

Again by example only, if a diet is to be customized for puppies, the recipe can be calculated to be caloric dense with the proper nutritional requirements necessary to support the needs of a growing puppy. Alternatively, if a companion animal is nursing or pregnant, the customized diet would be formulated to be caloric dense with the proper nutritional requirements necessary to support either the development of the unborn pups or the nursing needs of the nursing dog and her pups. If the joint health of the pet needs improvement and the companion animal is not a senior dog, the customized diet could be fortified with glucosamine and chondroitin sulfate in conjunction with gamma linoleic acid or other joint support supplements to help support joint function, with the addition of supplemental treats and chews. If a companion animal has itchy and scratchy or flaky skin a wet pet food with a fatty acid supplement may be recommended as part of the diet and caloric intake. If a companion animal's oral condition needs improvement or if the feeding format includes meaty treats, a treat such as a TARTER CHEW® would be recommended as part of the diet and caloric intake. Alternatively, if the feeding format of the companion animal includes biscuits or table scraps, a NUTRIBISCUIT® would be recommended as part of the diet and caloric intake.

The appropriate formulation for the customized dry kibble product and the additional pet food products necessary for a complete dietary health management system can be determined manually from the pet profile. Alternatively, the information from the pet profile can be input into a software program that will convert the information into an appropriate formulation for the customized dry kibble and will determine the proper wet food, functional snacks and treats and health accessories necessary to balance out the nutritional needs of the animal for a complete dietary health management system. The software program can also provide detailed feeding instructions as well as provide the labeling for the customized dry kibble product.

As an example, the software system could be a WINDOW based software system that accepts manual input about the general health conditions of an animal and converts this input into a recipe, a finished goods label and detailed feeding instructions. The system can run on a standard desk-top computer and is capable of performing basic mathematical algorithms. Input information can include the base kibble recipes, the different functional cocktails and the pet profile. The output for each custom product includes the blending ratios, the product label and feeding instructions. An example of a product label with feeding instructions is illustrated in FIG. **1** and an example of a Blending Ratio is illustrated below:

ITEM	DETAIL	Check When Added
Customer Name:	Sam Brown	
Customer #	KKVP9W1999	
Base Kibble 1	22.5 lb	
Base Kibble 2	15.0 lb	

-continued

ITEM	DETAIL	Check When Added
Mix together:		
Cocktail A - Joint Healtb	0.3 lb	
Cocktail B		
Cocktail C - Skin & Coat	0.1 lb	
Cocktail D		
Cocktail E - Digestive Healtb	0.1 lb	
Cocktail F		
TOTAL	38.0 lb	

The customized dry kibble product is manufactured by blending pre-made dry kibbles, adding additional functional ingredients and then packaging, labeling the finished product and sending the complete dietary health management system to the customer. The various base pet food kibble utilized in the customized kibble product is manufactured according to manufacturing processes known to one skilled in the art. An example of the kind of ingredients found in two different base dry kibble formulations, one for growth and the other for reduced energy, is illustrated below in Table 3.

TABLE 3

	Growth	Reduced Energy
Protein	28.1	24.1
Fat	18.1	8.2
Fiber	4.2	3.3
Ash	8.6	7.5
Moisture	9.0	9.0
1	Chicken	Rice
2	Chicken Meal	Chicken Meal
3	Oats	Rice Gluten
4	Rice Grain	Debulled Barley
5	Tallow	Tomato Pumace
6	Rice	Tallow
7	Debulled Barley	Animal Digest
8	Animal Digest	Omega Plus
9	Tomato Pumace	Grape Pumace
10	Omega Plus	Salt
11	Grape Pumace	Vitamin C 35%
12	Salt	Taurine
13	Vitamin C 35%	Vitamin E 50%
14	Taurine	Marigold Meal
15	Vitamin E 50%	Vitamins & Minerals
16	Marigold Meal	
17	Vitamins & Minerals	

FIG. **2** illustrates a process flow diagram of the manufacturing process and blending system for the customized dry kibble. In a first batching step, various dry ingredients, in their respective storage containers **10**, are fed into a single container **12** for mixing. The ingredient mixture is then fed into an extrusion machine **14**, which cooks the mixture and extrudes it into the appropriate sized shapes. The individual kibble pieces are then fed through a drying machine **16** and a continuous coating machine **18** in which the kibble pieces can be coated with any type of coating as is known in the art, such as a tallow mixture. To manufacture the customized dry kibble product, pre-made, dry kibble of various formulations and sizes is fed into multiple bulk storage containers **20** for the blending necessary to manufacture the customized dry kibble or pet food.

The blending system includes a storage container for each kind and size of kibble. For example, one storage container **20** can contain a high protein, small sized kibble; a second container **20** can contain a high protein, large sized kibble; a third container can contain a low fat, high fiber, small sized

kibble; a fourth container can contain a low fat, high fiber, large sized kibble, etc. A selected volume by weight of dry kibbles, pre-selected from the individual storage containers **20**, are fed into a single container **22** for blending. The blended kibble mixture is then fed through a batch coating machine **24** in which the blended kibble mixture is coated with the preselected functional cocktails according to the information from the pet profile. The customized dry kibble product is then packaged and labeled by a packaging/labeling machine **26** and sent to shipping where it is coupled with the proper wet food, functional snacks and treats, and health accessories that balance out the nutritional needs of the animal. The complete, customized dietary health management system is sent to the customer with specific feeding instructions for their animal. The customized dietary health management system, in addition to providing a balanced diet that is specific to the needs to the animal, also includes a feedback mechanism that allows the customized diet to be changed as the needs of the companion animal change.

EXAMPLE 1

An example of a customized dry kibble formulation for a small, young dog is illustrated in the table below:

CUSTOMIZED FORMULATION FOR TOY DOG PUPPY

INGREDIENTS/Small Kibbles	
Chicken	
Chicken meal	
Rice	
Rice Gluten	
Oats	
Animal Fats	
Barley, Dehulled	
Digest	
Flax Seeds/Fish Oil	
Tomato Pumace	
Grape Pumace	
Salt	
Vitamin E Acetate	
Ascorbic Mono phosphate	
Marigold Meal	
Vitamins	
Taurine	
PUPPY COCKTAIL	
Flax Seed Oil	
Sunflower Oil	
Chicory	
Flax Seeds/Fish Oil	
SKIN & COAT COCKTAIL	
Sunflower Oil	
Flax Seed Oil	
Vitamin E Oil	
MACRO NUTRIENTS	
Protein	
Fat	
Fiber	
Ash	
Moisture	
Carbohydmies	
Kcal/100 grams	363
Density kg/hl	45.0
Grams per Cup	107
Kcal per cup	388
COCKTAILS	
Puppy Cocktail	
Skin & Coat Cocktail	

The subject invention provides a customized diet and customized dietary health management system for companion animals that is selected on the basis of a pet's attributes and nutritional needs. The customized dietary health management system includes a customized dry kibble product and selected wet pet food, functional snacks and treats, and health accessories that together provide for all of the nutritional needs, plus selected nutriceuticals to help prevent and treat health issues of the companion animal. The dietary health management system is customized and manufactured for each companion animal and sent directly to the pet owner, veterinarian or animal health care provider on a regular basis. The system also includes a feedback mechanism that allow the dietary health management system to be adjusted as the needs of the companion animal changes.

One skilled in the art will readily appreciate that the present invention is well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as those inherent therein. The inventive customized pet food diet selected on the basis of a pet's attributes and nutritional needs, that includes a customized dry pet food kibble and selected wet pet food, functional snacks and treats and health accessories, packaged with specific feeding instructions for the pet described herein are presently representative of the preferred embodiments, are exemplary, and are not intended as limitations on the scope of the invention. Changes therein and other uses will occur to those skilled in the art which are encompassed within the spirit of the invention and are defined by the scope of the claims.

What is claimed is:

1. A method of producing a customized dry pet food product formulated from a dry pet food kibble recipe and selected functional ingredients, the formulation being selected on the basis of an individual pet's attributes and physical conditions, the method comprising the steps of:

a. providing a plurality of batches of different formulations of individual pre-made dry kibble pieces:

b. selecting at least a first formulation of the individual pre-made dry kibble pieces from the plurality of batches;

c. separating a predetermined volume of the at least first formulation of the individual pre-made dry kibble pieces from the selected batch;

d. providing a plurality of mixtures of functional ingredients;

e. coating the volume of dry kibble pieces with a mixture of functional ingredients selected from the plurality of mixtures;

f. packaging and labeling the predetermined volume of coated individual dry kibble pieces;

wherein the selection of the at least first formulation of the pre-made dry kibble and the selection of the mixture of functional ingredients is based on an individual pet's attributes and physical conditions in order to provide a customized dry pet food product.

2. The method of claim 1, wherein the mixtures of functional ingredients are selected from a group consisting of green lipped mussel extract, borage oil, sunflower oil, flax seed oil, flax seeds, fish oil, L-carnatine, conjugated linoleic acid, fructooligosaccharide, vitamin E oil, ground chicory, vitamin C, SAMME, Gamma linoenic acid, evening primerose oil, soy isoflavones, creatine, herbs, mannan oligosaccharides, and antioxidants.

3. The method of claim 2, wherein the functional ingredients provide health and disease prevention benefits selected from a group consisting of weight loss, joint health, digestive health, skin and coat health, wound healing, puppy health, senior pet health, immune system enhancement, and life enhancement.

4. The method of claim 1, wherein at least two formulations of individual pre-made dry kibble pieces are selected from the plurality of batches.

5. The method of claim 1, further including the step of adding to the customized dry pet food product a selected wet pet food, functional snacks and treats, and health accessories in order to provide a customized dietary health management system for companion animals.

6. The method of claim 5, wherein the customized dry pet food product and selected wet pet food, functional snacks and treats, and health accessories are packaged with feeding instructions and delivered to a pet owner, veterinarian or animal health care provider on a regular predetermined basis.

7. The method of claim 4, further including the step of blending the at least two selected formulations of the individual pre-made dry kibble pieces in a single container.

8. The method of claim 1, wherein the individual pet's attributes and physical conditions are based on information received from the pet's owner, veterinarian or animal health care provider.

9. The method of claim 8, wherein the information received from the pet's owner or veterinarian is input into a software system for formulation of the customized pet food product and the selection of wet pet food and functional snacks and treats required for a customized dietary health management system.

10. The method of claim 1, wherein the plurality of batches of different formulations of individual pre-made dry kibble pieces is selected from the group of formulations for growth or reduced energy.

* * * * *

EXHIBIT D

US006280779B1

(12) **United States Patent**
Nadeau et al.

(10) **Patent No.: US 6,280,779 B1**
(45) **Date of Patent: Aug. 28, 2001**

(54) **PET FOOD FOR MAINTAINING NORMAL BOWEL HEALTH**

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(58) **Field of Search** 426/2, 577, 578, 426/573, 805

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(57) **ABSTRACT**

A pet food composition comprising meat chunk and gravy, said gravy having chemically modified starch, gum, or mixtures thereof, in quantities less than that necessary to promote the production of stool quality that is unacceptable.

5 Claims, No Drawings

PET FOOD FOR MAINTAINING NORMAL BOWEL HEALTH

BACKGROUND OF THE INVENTION

Canned pet foods of the meat chunk and gravy type have been in the marketplace for years. They can be used as a total diet for pets or as a supplement to a pet's daily rations. Generally, the chunks are pieces of meat or meat by-products which are formed. This is the primary content of the chunk. Also present in the chunk are usually grains and fibrous materials as well as vitamins and nutrients. These materials are generally present as the minor portion of the chunk. The gravy portion usually has a fluid characteristic and supplies aroma, palatability, and some additional nutritional properties to the food product such as additional vitamins, minerals, and the like. Also present in the market place are other discrete meaty forms in a discrete separate gravy product. These forms are sometimes known as "slices", that is where the discrete meat portion is somewhat elongated, as relatively flat as in a delicatessen sliced meat. As utilized throughout this specification and claims the term "chunk" shall include slices as well as any other discrete meat containing composition which is separate from the discrete gravy component of the diet. In each of these cases, the "chunks" are present with the gravy as a single unit, for example, sold in a container.

We have recently noted that the usage of meat chunk and gravy diets for animals, particularly canines, have a specific problem. In all of the canines tested with various marketed meat chunk and gravy diets as the sole diet for the canine, the animals encountered significant irregularity in fecal discharge. This is manifested by the appearance of loose, watery stools, or straight diarrhea when the animal defecates.

After a significant study, we have discovered the cause of this problem and a manner in which to essentially eliminate or substantially reduce the problem. This solution lies in the elimination or substantial reduction of certain materials utilized in the gravy portion of the diet, specifically, chemically modified starch(es), gum(s), and mixtures thereof.

SUMMARY OF THE INVENTION

In accordance with the invention, there is a pet food composition comprising meat chunk and gravy, said gravy having chemically modified starch, gum, or mixtures thereof in quantities less than that necessary to promote the production of stool quality which is unacceptable.

A further aspect of the invention is a method for inhibiting the production of unacceptable stool quality in pets fed at least primarily a chunk and gravy diet which comprises feeding the pet a chunk and gravy diet wherein the gravy has a chemically modified starch, gum, or mixtures thereof, in quantities below that necessary to promote production of stool quality which is unacceptable.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Included within the term meat are those meat-derived ingredients defined as "meat" and "meat by-products" by the current Definitions of Feed Ingredients published by the Association of American Feed Control Officials, Incorporated. As defined, the term "meat" includes not only the flesh of cattle, swine, sheep and goats, but also other mammals, poultry and fish. The term "meat by-products" is defined to include non-rendered parts of the carcass of slaughtered animals, poultry and the like. Preferred meat sources include lamb, pork, chicken, and the like. Meat includes the striated muscle. Meat by-products include liver, spleen, heart, and lung. Meat and meat by-products comprise about 60 to about 85% of the meat chunk component of the meat chunk and gravy food product. The remainder of the meat chunk generally comprises grains, fibrous materials, vitamins, and the like. Some of these are effective binding agents for the meat chunk as well. Wheat flour, dry blood plasma and dried egg are effective binding agents for the meat derived ingredients from which the meat chunks are manufactured. Preferred meat chunk formulations will contain from about 4 to 8% by weight wheat flour, from 0.5 to about 7% by weight dry blood plasma and about 2 to about 4% dried egg. Vitamins and minerals can also be added.

In addition to these ingredients, various minor ingredients such as nutritional supplements, salts, coloring agents, and the like, are also included in the meat chunk formulation to provide nutritional balance and palatability.

The gravy component is prepared for canning with the meat pieces. The gravy component typically comprises water and thickening agents. We have found that thickeners commonly employed in the gravy component of a meat chunk and gravy diet for pets, particularly those directed to canines, are responsible for loose stools or diarrhea usually observed in these animals, particularly canines, when fed a diet principally or solely of meat chunk and gravy. These thickeners are chemically modified starch(es), gum(s) and mixtures thereof. Examples of chemically modified starches include starches from corn, wheat, rice, potato, tapioca and the like which are modified by any or a mixture of acylation such as acetylation, cross-linking from groups such as phosphate, hydroxyalkyl such as hydroxypropyl. Examples of gums include xanthan, guar, locust bean, carboxymethylcellulose, and the like. It is most desirable to not use any of these thickening agents. However, any amount of these thickening agents which does not promote the production of stool quality which is unacceptable from the concept of formed versus watery can be employed. Generally, less than about 0.2 wt % of the diet of these thickeners can be present.

Desirably, less than about 0.1 wt % of the diet should be present. Most desirable is the absence of these thickeners.

Materials which can be employed to thicken the gravy, liquid component of the meat chunk and gravy diet are standard, chemically unmodified starches available from various food sources including wheat, corn, rice, potato, tapioca, and the like. These materials are used in quantities to assist in bringing about the desired gravy thickness and consistency. Generally, this is about 1.5 to about 3 wt % of the diet. The preferred starch is a physically modified, waxy rice starch.

Other ingredients, which may be included in the gravy component, are soluble carbohydrates such as maltodextrin, sucrose and corn syrup, as well as also salts, color, flavors and emulsifiers such as lecithin. Desirably, a mixture of from about 1 to about 5% by weight of the chemically unmodified starch, from 0 to about 12% by weight maltodextrin and about 70 to about 95% by weight water are blended at 60 to 195° F. to provide a thickened gravy which is applied to the meat pieces immediately after the meat pieces have been placed into the can before sealing and sterilizing.

The meat chunk component is prepared by first grinding frozen meat under controlled conditions to prevent the temperature of the meat from rising above 38° F. The meat is ground to a relatively fine grind by passing broken frozen

blocks of the meat through a grinder where the meat is sized to particles between ⅜ and ½inch. The comminuted, sized particles are fed to a meat emulsion blender where the meat particles are blended with oat fiber, when employed, binders such as plasma, wheat flour and dry egg, nutrients, minerals and salts to form a meat mixture. The oat fiber is added generally in the form of particles, which desirably pass through a sieve of about 200 microns. The meat mixture is then heated to raise the temperature of the meat mixture to between about 32° and 40° F. whereupon the mixture is emulsified and vacuum deaerated, to remove entrained air at 25–30 inches mercury.

A meat emulsifier is used to reduce the particle size of the mixture ingredients and create a fine, homogeneous meat mixture, which will not separate upon further processing. The temperature of the meat mixture during the emulsification step is maintained between about 40° F. and 60° F. and preferably about 40° to 50° F. The so prepared meat emulsion is transferred through an extruder from which it is uniformly deposited, as a sheet or elongated shape, having a thickness of about ¼ to 1 inch, onto a moving cooking belt of the desired dimensions. The cooking belt with the meat emulsion deposit is passed through a cooker and cooked to an internal meat temperature of about 175° to 200° for about 2 to 9 minutes to fully cook the meat mixture and then cooled to between about 140° to 180° F. to develop the desired texture. At this point the meat is divided or cut to the desired chunk dimensions generally about ½×½inches.

The gravy in which the meat chunks are to be packaged is prepared separately from the meat pieces. After preparation, the gravy is heated in accordance with the following preferred sequence: about 190° F. for 15 minutes, about 195° F. for 10 minutes and 200° F. for 7 minutes. Thereafter, the gravy can either be cooled or left at the cooking temperature until it is blended with the meat chunks and then deposited into the cans. The cans containing meat and gravy are sealed and sterilized according to commercial sterilization requirements.

The invention is further illustrated by the following specific, but non-limiting Examples.

EXAMPLE I

MEAT CHUNK-IN-GRAVY PET FOOD COMPOSITIONS

A series of meat chunk-in-gravy pet foods designated Pet Food X, Y and Z were prepared following the procedure previously described using the ingredients as listed in Tables I–III.

TABLE 1

Meat-In-Gravy Pet Food X

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Meat and Meat By-Product	76.63	0	36.10
Fiber and Binding Agent	19.74	0	9.30
Vitamins	0.26	0	0.12
Minerals	0.87	0	0.41
Water	2.50	88.52	48.00
Maltodextrin	—	7.96	4.21
Starch	—	3.01	1.59
Lecithin	—	0.51	0.27
Total	100.00	100.00	100.00

TABLE II

Meat-In-Gravy Pet Food Y

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Meat and Meat By-Product	76.26	0	35.90
Fiber and binding Agent	19.75	0	9.30
Vitamins	0.26	0	0.12
Minerals	1.23	0	0.58
Water	2.50	88.7	48.10
Maltodextrin	—	7.6	4.00
Starch	—	3.02	1.60
Lecithin	—	0.51	0.27
Carmel color	—	0.17	0.09
Total	100.00	100.00	99.96

TABLE III

Meat-In-Gravy Pet Food Z

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Meat and Meat By-Product	75.34	0	35.70
Fiber and binding Agent	20.05	0	9.50
Vitamins	0.26	0	0.12
Minerals	1.71	0	0.80
Water	2.64	88.28	47.70
Maltodextrin	—	7.83	4.12
Starch	—	3.04	1.60
Lecithin	—	0.51	0.27
Carmel color	—	0.34	0.18
Total	100.00	100.00	99.99

In preparing Pet Foods X, Y and Z, blocks of frozen meat and meat by-products were ground through a grinder equipped with ¼inch hole grind plate. The meat ingredients were mixed with dry and liquid ingredients in the amounts listed in Tables I–III. Mixing was performed in a twin ribbon mixer and then emulsified through an emulsifier. The resulting fine emulsion was deaerated using in a Marlen Vacuum Hopper equipped pump. The meat emulsion extruder is equipped with a variable die capable of producing ¼ to 1 inch thick, 12 inch wide emulsion sheet at the rate of 200 lb./hr. The ¼sheet was passed through a steam tunnel, with a residence time of about 5 minutes. The temperature of uncooked emulsion entering the steam tunnel was between about 40–60° F. and was raised to about 175–195° F. at the steam tunnel discharge. The cooked, firm, solid sheet was sliced into ¾inch x¾inch chunks at 140–180° F. and mixed with cooked gravy and deposited into cans.

The gravy was prepared according to the formula given in Tables I–III and added to the meat chunks in the can. The filled cans were sterilized in a still retort at 252° F. for 75 minutes.

Pet food X is high in chicken, Y is high in lamb, and Z is high in beef.

The compositions of the comparative commercial diets were obtained from the ingredients listed on the labels of the food package and are recorded in Tables IV–VIII below. DMB as used throughout is dry matter basis.

TABLE IV

Diet A

Ingredients: water, chicken, turkey, lamb, meat by-products, wheat gluten, whole rice, corn starched-modified, wheat flour, salt, potassium chloride, tricalcium phosphate, caramel color, sodium tripolyphosphate, natural flavor, minerals, vitamins

NUTRIENT	LEVEL (%)
Moisture (as is)	80.17
Protein (DMB)	42.21
Crude Fiber (DMB)	0.50
Crude Fat (DMB)	24.66
Ash (DMB)	7.82
Calcium (DMB)	1.26
Phosphorus (DMB)	1.01
Magnesium (DMB)	0.07
Sodium (DMB)	1.06
Metabolizable Energy (DMB)	442 Kcal/Kg

TABLE V

Diet B

Ingredients: water, poultry, beef, meat by-products, wheat flour, wheat gluten, salt, sunflower oil, caramel color, sodium tripolyphosphate, natural flavors, guar gum, sodium alginate, minerals, vitamins, xanthan gum, onion powder, garlic powder

NUTRIENT	LEVEL (%)
Moisture (as is)	81.45
Protein (DMB)	45.93
Crude Fiber (DMB)	1.08
Crude Fat (DMB)	22.26
Ash (DMB)	10.84
Calcium (DMB)	1.83
Phosphorus (DMB)	1.56
Magnesium (DMB)	0.07
Sodium (DMB)	1.89
Metabolizable Energy (DMB)	4196 Kcal/Kg

TABLE VI

Diet C

Ingredients: water, beef, chicken, liver, meat by-products, food starch-modified, iodized salt, dextrose, guar gum, steamed bone meal, sodium tripolyphosphate, caramel natural flavor, minerals, vitamins

NUTRIENT	LEVEL (%)
Moisture (as is)	79.40
Protein (DMB)	42.48
Crude Fiber (DMB)	0.97
Crude Fat (DMB)	29.90
Ash (DMB)	11.31
Calcium (DMB)	1.41
Phosphorus (DMB)	1.41
Magnesium (DMB)	0.07
Sodium (DMB)	2.28
Metabolizable Energy (DMB)	4563 Kcal/Kg

TABLE VII

Diet D

Ingredients: water, beef, animal liver, turkey, wheat gluten, chicken, soy flour, corn starch-modified, potassium chloride, caramel color, steamed bone meal, salt, minerals, vitamins, natural flavor

NUTRIENT	LEVEL (%)
Moisture (as is)	78.81
Protein (DMB)	54.41
Crude Fiber (DMB)	0.94

TABLE VII-continued

Diet D

Ingredients: water, beef, animal liver, turkey, wheat gluten, chicken, soy flour, corn starch-modified, potassium chloride, caramel color, steamed bone meal, salt, minerals, vitamins, natural flavor

NUTRIENT	LEVEL (%)
Crude Fat (DMB)	20.81
Ash (DMB)	7.27
Calcium (DMB)	1.37
Phosphorus (DMB)	1.04
Magnesium	0.10
Sodium (DMB)	0.39
Metabolizable Energy (DMB)	4253 Kcal/Kg

TABLE VIII

Diet E

Ingredients: meat broth, beef, chicken, turkey, meat by-products, wheat flour, wheat gluten, pea fiber, caramel color, salt, sodium tripolyphosphate, guar gum, natural flavors, sodium alginate, potassium chloride, xanthan gum, onion powder, garlic powder, minerals, vitamins

NUTRIENT	LEVEL (%)
Moisture (as is)	79.66
Protein (DMB)	45.53
Crude Fiber (DMB)	2.46
Crude Fat (DMB)	25.12
Ash (DMB)	11.46
Calcium (DMB)	2.02
Phosphorus (DMB)	1.7
Magnesium (DMB)	0.09
Sodium (DMB)	1.77
Metabolizable Energy (DMB)	4269 Kcal/Kg

In a series of separate seven day feeding tests, ten adult beagle dogs were fed only Pet Foods X, Y, Z. The dogs were allowed 45 minutes to consume the pet food. Two types of feeding were evaluated (a) ad libitum, that is 1200 grams of food offered/day or (b) maintenance whereby the dogs were fed to maintain their optimal body weight. Feces eliminated by each dog were evaluated daily and given a grade based on the observed physical condition of the fecal matter. The grades given were as follows:

Grade 1 Greater than two thirds of the feces in the defecation are liquid. The feces have lost all form, appearing as a puddle or squirt.

Grade 2 Solid-liquid feces are an intermediate between soft and liquid feces. Approximately equal amounts of feces in defecation are soft and liquid.

Grade 3 Greater than two-thirds of the feces in a defecation are soft.

The feces retain enough form to pile but have lost their firm cylindrical appearance.

Grade 4 Firm-soft feces are an intermediate between the grades of firm and soft. Approximately equal amounts of feces in a defecation are firm and soft.

Grade 5 Greater than two-thirds of the feces in a defecation are firm. They have a cylindrical shape with little flattening.

The higher the grade, the less gastrointestinal dysfunction experienced by the animals. Dogs fed food compositions, in which the fecal matter eliminated was graded 3-4-5, were considered suitable for commercial use. Food fed the dogs in which the eliminated fecal matter was graded 1-2 was considered unacceptable for any purpose.

For purposes of comparison, the feeding test procedure of the Example was repeated except the five commercial meat

chunk and gravy type pet foods designated "Diets A, B, C, D and E" were evaluated for the condition of the fecal discharge of the test animals.

The results of the feeding studies are rendered in Table IX below:

TABLE IX

DIET	FEEDING LEVEL	STOOL GRADE FREQUENCIES (%) 1	2	3	4	5
X - Chicken in gravy (3% starch)	Ad libitum	0	9	22	48	22
	Maintenance	1	0	7	12	80
Y - Lamb in gravy (3% starch)	Ad libitum	5	6	22	35	32
	Maintenance	0	0	8	58	34
Z - Beef in gravy (3% starch)	Ad libitum	1	3	18	33	45
	Maintenance	1	1	7	12	79
Diet A	Ad libitum	4	9	11	31	46
	Ad libitum	14	13	35	32	6
	Maintenance	1	14	29	32	24
Diet B	Ad libitum	5	25	30	24	16
Diet C	Ad libitum	36	8	21	23	12
	Maintenance	21	17	36	16	10
Diet D	Ad libitum	7	17	24	27	25
Diet E	Ad libitum	18	18	13	20	31

The results recorded in Table IX show that the proposed invention produces significantly better stool quality than the commercially available products of similar meat chunk and gravy form. In general, when the invention diet is fed as the sole source of nutrition, the maintenance level feedings produce superior results than ad libitum, indicating a dosage related effect.

Additionally, other gravy thickening systems were found to produce poor stool quality. A series of thickening systems were tested using a common chunk formula. Table X lists the stool quality rating for each system.

TABLE X

DIET	FEEDING LEVEL	STOOL GRADE FREQUENCIES (%) 1	2	3	4	5
F - chunks + 0.5% guar gum + 99% water	Ad libitum	34	21	18	16	11
G - chunks + 0.19% Xanthan Gum	Ad libitum	30	45	21	3	1
H - chunks + 0.42% CMC	Ad libitum	5	19	32	30	14
I - chunks + 2.09% HP starch	Ad libitum	6	24	27	31	12
J - chunks + 0.16% CMC + 2.61% P linked potato starch	Ad libitum	9	18	32	28	13
K - chunks + 2.1% waxy rice starch + 3.68% 5 - D.E. Maltodextrin + 0.26% lecithin	Ad libitum	0	5	9	25	61

The results shown in Table X indicate that only thickening system K provided acceptable stool quality. All other thickening systems produced significant watery, loose stools. The formulas of each of the thickening systems are provided in Tables XI–XVI.

TABLE XI

Meat-In-Gravy Pet Food F

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Chicken neck	30.40	0	14.50
Pork Liver	23.06	0	11.00
Beef lungs	23.06	0	11.00
Wheat flour	8.39	0	4.00
Oat fiber	6.29	0	3.00
Plasma	5.24	0	2.50
Vitamins	0.25	0	0.12
Minerals	0.80	0	0.38
Water	2.51	99.00	52.98
Guar Gum	—	1.00	0.52
Total	100.00	100.00	100.00

TABLE XII

Meat-In-Gravy Pet Food G

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Chicken neck	27.39	0	13.20
Pork liver	26.97	0	13.00
Beef lungs	18.67	0	9.00
Wheat flour	8.30	0	4.00
Oat fiber	6.22	0	3.00
Plasma	4.15	0	2.00
Vitamins	0.24	0	0.11
Minerals	0.79	0	0.38
Water	7.27	85.10	47.50
Maltodextrin 10 D.E.	0	7.14	3.70
Starch	0	2.00	1.04
Lecithin	0	0.56	0.29
Corn Syrup solids	0	4.83	2.59
Xanthan gum	0	0.37	0.19
Total	100.00	100.00	100.00

TABLE XIII

Meat-In-Gravy Pet Food H

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Chicken neck	30.40	0	14.50
Pork liver	23.06	0	11.00
Beef lungs	23.06	0	11.00
Wheat flour	8.39	0	4.00
Oat fiber	6.29	0	3.00
Plasma	5.24	0	2.50
Vitamins	0.25	0	0.12
Minerals	0.80	0	0.38
Water	2.51	99.20	53.08
CMC	—	0.80	0.42
Total	100.00	100.00	100.00

TABLE XIV

Meat-In-Gravy Pet Food I

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Chicken neck	30.40	0	14.50
Pork liver	23.06	0	11.00
Beef lungs	23.06	0	11.00

TABLE XIV-continued

Meat-In-Gravy Pet Food I

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Wheat flour	8.39	0	4.00
Oat fiber	6.25	0	3.00
Plasma	5.24	0	2.50
Vitamins	0.25	0	0.12
Minerals	0.80	0	0.38
Water	2.51	96.00	51.41
Starch, instant waxy maize	—	4.00	2.09
Total	100.00	100.00	100.00

TABLE XV

Meat-In-Gravy Pet Food J

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Chicken neck	30.40	0	14.50
Pork liver	23.06	0	11.00
Beef lungs	23.06	0	11.00
Wheat flour	8.39	0	4.00
Oat fiber	6.29	0	3.00
Plasma	5.24	0	2.50
Vitamins	0.25	0	0.12
Minerals	0.80	0	0.38
Water	2.51	84.10	45.17
Maltodextrin 5 DE	0	10.00	5.23
Starch, phosphate cross-linked	0	5.00	2.61
Lecithin	0	0.60	0.31
CMC	0	0.30	0.16
Total	100.00	100.00	100.00

TABLE XVI

Meat-In-Gravy Pet Food K

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Chicken neck	24.47	0	14.00
Pork liver	24.21	0	11.50

TABLE XVI-continued

Meat-In-Gravy Pet Food K

INGREDIENTS	% OF MEAT EMULSION	% OF GRAVY	% OF PRODUCT
Beef lungs	23.15	0	11.00
Wheat flour	5.68	0	2.70
Oat fiber	8.42	0	4.00
Egg	4.21	0	2.00
Plasma	1.05	0	0.50
Vitamins	0.25	0	0.12
Minerals	0.86	0	0.41
Water	2.70	88.50	47.73
Maltodextrin 5 DE	—	7.00	3.68
Starch native waxy rice	—	4.00	2.10
Lecithin	—	0.50	0.26
Total	100.00	100.00	100.00

The composition of invention inhibits the production of unacceptable stool quality when a pet, particularly a dog, is fed a standard "chunk and gravy" diet having modified starch and/or gums therein as the primary, essentially all, or complete daily diet.

What is claimed is:

1. A method of substantially increasing stool quality in a pet which has experienced unacceptable stool quality after ingesting primarily a meat chunk and gravy diet having unacceptable stool quality inducing quantities of a chemically modified starch, gum or mixtures therein comprising feeding said pet a meat chunk and gravy diet having zero to less than the quantity of chemically modified starch, gum or mixture thereof necessary to bring about unacceptable stool quality.

2. The method in accordance with claim **1** wherein the pet is a canine.

3. The method in accordance with claim **2** wherein the canine pet food has zero to about 0.2 wt. % of a chemically modified starch, gum or mixture thereof.

4. The method in accordance with claim **3** wherein the canine pet food has zero to about 0.1 wt. % of a chemically modified starch, gum or mixture thereof.

5. The method in accordance with claim **4** wherein the canine pet food has no chemically modified starch, gum or mixture thereof.

* * * * *

EXHIBIT E

US006042857A

United States Patent [19]

Jones et al.

[11] **Patent Number: 6,042,857**

[45] **Date of Patent: *Mar. 28, 2000**

[54] **COMBINATION CONTAINER AND DRY PET FOOD FOR INCREASED SHELF LIFE, FRESHNESS, PALATABILITY, AND NUTRITIONAL VALUE**

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[73] Assignee: **Seal Rock Technologies Incorporated**, Palm Beach, Fla.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/318,179**

[22] Filed: **May 25, 1999**

Related U.S. Application Data

[63] Continuation of application No. 08/912,410, Aug. 18, 1997.

[51] **Int. Cl.**[7] **B65D 85/00**; A23K 1/00

[52] **U.S. Cl.** **426/106**; 426/392; 426/418; 426/635; 383/103; 383/109; 428/34.3; 428/34.6; 428/36.7

[58] **Field of Search** 426/106, 335, 426/327, 635, 118, 392, 418; 383/109, 103; 428/34.3, 34.6, 36.7

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[57] **ABSTRACT**

The combination of a substantially gas impermeable container and a dry pet food of high soluble fiber content that has a water activity within the range of 0.5 to 0.8. The result is long lasting, highly nutritious dog food that can be substantially free of added preservatives, antimycotics, and other unnatural chemicals.

20 Claims, No Drawings

COMBINATION CONTAINER AND DRY PET FOOD FOR INCREASED SHELF LIFE, FRESHNESS, PALATABILITY, AND NUTRITIONAL VALUE

CROSS REFERENCE TO RELATED APPLICATION

This application is a Continuation of Ser. No. 08/912,410, filed on Aug. 18, 1997.

FIELD OF THE INVENTION

This invention relates generally to a package or container and dry pet food combination that does not require preservatives or removal of oxygen from the bag and particularly to the resulting increased shelf life, freshness, palatability, and nutritional value of the dry pet food in combination with the container.

BACKGROUND OF THE INVENTION

Companion pets, such as dogs and cats, are important family members and may live to be 15, 20 or even more years contributing to the well being and mental health of the family. These companion animals longevity will best be served through good nutrition, therefore, it is important to protect the nutritional content, digestibility, and palatability of the companion pet food.

Pet foods are now generally classified into three types by their water content, namely: dry pet foods which generally have a water content of less than about 15% by weight, more particularly within the range of approximately 6–12%; semi-moist pet foods which generally have a water content of 20–40% by weight, and pet foods which have a high water content of more than 45% by weight, more particularly in the range of about 65–85%.

Pet foods having a high water content are generally sold in canned form. These canned pet foods require retorting because the high content of water is suitable for growth of microorganisms. Moreover, after can opening, the canned food should be stored in a refrigerated state because they undergo spoilage very soon. Thus the pet foods of high water content in canned form require high cost for processing in canning, and are inconvenient to store. The dry pet foods and the semi-moist pet foods are easier to package and transport, and need not be refrigerated after they are opened. They are easy to give animals, and are convenient to pet keepers.

The products of semi-moist content are unstable unless they contain extensive additives, some of which may be harmful to the animal. Due to their higher level of moisture content, they are more susceptible to microorganism growth than dry pet foods. Microorganisms which may cause spoilage are living in the products of semi-moist content because their water content is not so low as to inhibit growth of microorganisms and the temperature for heat treatment of these products is not so high as to achieve complete sterilization. Even if the products are heat-sterilized completely, they are susceptible to secondary contamination because they are packed in a simplified form. The products of semi-moist content, therefore will spoil soon if no measure is taken. The most prevalent practice of preventing microbial growth is to add some form of preservatives and/or antimycotics.

The dry pet foods contain up to about 15% moisture by weight and are the simplest to handle and store and least expensive to ship. Hard, dry pet food, while being easy to store and handle, is not as palatable as the other classes of pet food for some animals. Thus, although dry pet food may be very nutritional, in some cases it is not a particularly acceptable pet food to either the pet or the pet owner. This lower palatability is due partly to the deterioration of the pet food or overdrying of the pet food in an effort to prevent deterioration.

Two major causes of deterioration in dry pet food are microbial growth and oxidation. Both of these deterioration factors cause decreased diet palatability and decreased nutritional value. In addition, microbial growth also increases the risk of food intolerance. Some microorganisms and the toxins they produce may cause vomiting, diarrhea, and even death of animals consuming them. Problems associated with pet food oxidation also include decreased immune function and therefore increased susceptibility to infectious diseases. Cardiovascular diseases, muscular dystrophy, or degeneration and steatitis, any of which may result in death, also occur as a result of the ingestion of oxidized or rancid food. Although oxidation of commercial pet food severe enough to cause these effects is uncommon, sufficient oxidation to result in decreased diet palatability and a dry lusterless hair coat is quite common.

Methods commonly used to minimize these effects is to dry the food sufficiently to prevent microbial growth and to add preservatives to the food. Too much drying of the food however makes it hard and crumbly reducing the foods palatability to pets. Further, the heat used to dry the food increases oxidation and, if the heat is sufficient, it also decreases the diet's digestibility. Preservatives used are primarily anti-oxidants, although substances such as sugars and propylene glycol have been added to bind water making it unavailable either for microbial growth or oxidation. The major anti-oxidants used are mixed tocopherols, various acids, and synthetic chemicals such as BHA, BHT, and most commonly ethoxyquin. Ethoxyquin, which is used as an antioxidant in rubber products, is well recognized as one of the most efficient antioxidants available. Although it is allowed in pet foods, it is not allowed in foods intended for people and many question its safety for pets. A 3.5 years, two consecutive generations, study of beagle dogs showed that liver pigmentation changes and elevated liver enzymes were found in dose-dependent levels following ingestion of ethoxyquin. *Pet Food Industry*, 38(3):51–53, (May/June 1996). While the study concluded that the liver pigmentation was not considered critically significant and the dog's overall health did not appear to be affected, an alternative to such additives would be preferred. Whether true or not, many pet owners believe that these chemicals, particularly ethoxyquin, are harmful to their pets.

In addition to the problems associated with anti-oxidants, the large amount of sugar and/or sugar alcohols sometimes added, reaching as large as 20–35% by weight, is too high for usual feeds of animals and is detrimental to nutritional balance. Moreover, a high sugar content causes poor digestion in certain animals, especially old animals. Further, propylene glycol used as an antiseptic could have potentially adverse affects on the health of an animal after long term feeding of pet foods containing large amounts of propylene glycol. Accordingly, none of these measures are entirely satisfactory because of the problems of nutritional balance, the health of the animals, and palatability. Further, attempts to solve these problems have heretofore resulted in wide variations in the storagability of pet foods.

Regardless of the procedures taken to prevent dry pet food deterioration, those currently used are inadequate. In a recent study, Dr. Jim Corbin, University of Illinois, reported that "of 37 various commercial pet foods from store shelves,

43% had peroxide values in excess of 20 meq/kg of fat". *Pet Food Industry,* 38(1)6, (January–February 1996). Animal fat rancidity odor is easily detected by, and food palatability decreased for people at peroxidated values of 20 meq/kg or greater. Since a dog's sense of smell is 50–100 times more sensitive the people's, a much lower value is undoubtedly detected by them, decreasing the diet's palatability. This degree of oxidation also decreases the nutritional value of required essential or unsaturated fatty acids, which if sufficiently severe results in their deficiency affects. This is first indicated by a dry lusterless hair coat, a common problem in dogs receiving dry commercial dog food.

To prevent these effects, vacuum packaging in gas impermeable bags has recently been used. Although this method quite likely is effective, no results currently have been published or made available. In addition, vacuum packaging of pet foods has several major disadvantages include: costly equipment, a rate of production too slow for most manufacturing plants, and a rough poorly readable package unacceptable to many retailers and pet owners. Of three companies that have so far tried vacuum packaging, one has stopped using it and the other two have gone out of business.

Two things, water and oxygen, are necessary for microbial growth in and oxidation of a food. The present invention inhibits microbial growth and oxidation of pet food through minimizing both the water and oxygen available for food spoilage to occur. This decrease in available water and oxygen is accomplished without the use of chemical preservatives or vacuum packaging, thus eliminating the problems associated with them as mentioned above.

In addition, the present invention will provide numerous health benefits over prior art container and dry pet food combinations. In addition, the present invention provides maintained freshness and palatability as well as nutritional value of the pet food. Finally, the present invention permits prolonged shelf life and decreased production, storage and transportation costs.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a combination container and dry pet food that inhibits microbial growth and oxidation without the use of vacuum packaging or addition of chemical preservatives.

Another objective of the invention is to provide a combination container and dry pet food with maintained freshness, improved palatability, and maintained nutritional value.

It is a further object of the invention to provide a combination container and dry pet food with prolonged shelf life.

Yet another objective of the invention is to provide a combination container and dry pet food that results in decreased production, storage, and transportation costs.

Additional objectives and advantages of the invention will be set forth in part in the description that follows, and in part will be obvious from the description, or may be learned by the practice of the invention. The objects and advantages of the invention will be obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims. To achieve the objects and in accordance with the purpose of the invention, as embodied and broadly described herein, the present invention provides a combination container and dry pet food with increased shelf life, freshness, palatability, and nutritional value.

Ingredients high in soluble fibers such as oats, flax seed meal and psyllium, were selected and used to produce a diet high in soluble fiber. This is the preferred natural dog food for this invention. These fiber ingredients were used instead of the corn, wheat or animal ingredients which are commonly used in the pet food industry but contain little soluble fiber. Soluble fiber confers many health benefits including: assisting in the normalization of intestinal transit; prevention of diarrhea, constipation, or excessive hard stools; a decrease in blood cholesterol, therefore, preventing cardiovascular disease; binding of pathogens in the intestinal track, therefore reducing their effect; and a decrease in post prandial hyperglycemia. In addition to these numerous health benefits, soluble fiber also binds 30–70 times their weight of water rendering the water unavailable from microbial growth and for oxidation. The amount of edible soluble fiber material present in the pet food is preferably above 3% by weight and most preferably within the range of 5% to 15% by weight.

In another embodiment, the invention comprises a combination container and dry pet food wherein the container is gas impermeable, therefore further minimizing oxidation without the need for removing oxygen from the bag either by vacuum, nitrogen fill or oxygen scavengers.

Yet another embodiment of the invention comprises a combination container and dry pet food that results in prolonged shelf life due to the minimized oxidation and reduced bacterial growth and decreased production storage and transportation costs. These reductions in cost are due to the ability to produce a greater quantity of pet food in a single run, no additional cost necessary to nitrogen fill or provide oxygen scavengers in the container to remove oxygen, and no special temperature or humidity requirements. This longer shelf life further results in the ability for a shopkeeper to order more pet food per order thereby decreasing the cost of shipping per unit.

The method and package used to achieve these objectives as well as others will become apparent from the following detailed description of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the presently referred embodiments of the invention, which together with the following examples, serve to explain the principles of the invention and the synergy of the combination.

The invention relates to a combination container and dry pet food. It provides a means for storing dry pet food with maintained freshness, palatability, and nutritional value, as well as prolonged shelf life. In addition, the invention relates to a combination container and dry pet food that allows for decreased production, storage, and transportation costs.

In an effort to provide to the pet food industry a pet food that is both palatable and easy to store, and with a reasonable shelf life, the pet food industry has focused much effort in the area of preserving the different moisture classes of pet food. See for example, Friedman et al., U.S. Pat. No. 4,495,208 issued Jan. 22, 1985; Ueno et al., U.S. Pat. No. 4,444,796 issued Apr. 24, 1984; Bone et al., U.S. Pat. No. 4,273,788 issued Jun. 16, 1981; Ernst et al., U.S. Pat. No. 4,158,706 issued Jun. 19, 1979; and Bernotavicz, U.S. Pat. No. 3,985,904 issued Oct. 12, 1976, all of which are incorporated herein by reference. Broadly speaking, these prior art pet food compositions used a combination of high heat treatment and the addition of preservatives and/or antimycotics. In addition, these products frequently have included a high level of sugars, edible organic acids and inorganic acids to maintain pH. Finally, the packaging of

these pet food products includes reduction of available oxygen through vacuum packaging, nitrogen fill, or oxygen scavengers. Thus the package is costly as is the process and food quality, especially its natural state, is sacrificed with preservatives, flavor masks, etc.

In the present invention, the water and oxygen necessary for microbial growth in and oxidation of food are minimized through the use of soluble fiber and a container constructed of gas impermeable materials.

One way to reduce the water available for microbial growth and for oxidation is to bind the water. In the present invention, soluble fiber is used which binds water in the range of about 30–70 times the weight of the soluble fiber. The amount of water available, or unbound, is indicated by a food or substance's water activity. As shown in Table 1 a water activity of 0.64 or less insures the absence of microbial growth and at 0.4 to 0.5 oxidation rate is the slowest. In the present invention, this water activity is kept at a range of about 0.5 to about 0.8 and preferably 0.7 or below, and a percent moisture by weight of pet food at about 6% to 10%.

TABLE 1

Water Activity (W.A.) and its Effects

W.A.	Effects
1.0	100% of water is unbound or available
0.90	90% of water is unbound or available
<0.90	most microorganisms can't grow because of inadequate water available
0.80	oxidation rate is 120% above minimum
0.70	oxidation rate is 70% above minimum
0.64	lowest W.A. at which any organisms can grow and therefore below which is optimum to ensure their absence
0.60	oxidation rate is 25% above minimum
0.40–0.50	oxidation rate is slowest
0.30	oxidation rate is 16% above minimum
0.20	oxidation rate is 45% above minimum
0.10	oxidation rate is 110% above minimum

In one embodiment of the present invention, the pet food is comprised of ingredients consisting of flax seed meal, lentils, oat groates, peas, sunflower seed oil, canola seed meal, rice, dehydrated cane juice, yeast, sea kelp, calcium carbonate, salt, psyllium and spirulina (listed in order of decreasing amount in the diet). The dry pet food also contains 20% crude protein, 15% crude fat, 8% moisture, 5% crude fiber and 5% ash. This results in a pet food that is several times higher than most pet foods in unsaturated fatty acids which are susceptible to oxidation and in soluble fiber to bind water to reduce microbial activity and oxidation.

In the present invention, the gas impermeable container in which the dry pet food is stored, minimizes the available oxygen without resorting to vacuum packaging or oxygen scavengers. There are several oxygen barrier materials available that can be used in the creation of a gas impermeable container. See for example, Anderson, U.S. Pat. No. 5,500, 303 issued Mar. 19, 1996, incorporated herein by reference. A surprising result was that neither use of preservatives nor removing oxygen from the bag either by vacuum, nitrogen flush or oxygen scavengers is necessary when the food composition described is sealed in a gas impermeable bag as described. Virtually no oxidation occurs during storage, thus, with this invention shelf life of pet food can be prolonged and freshness, palatability, and nutritional value maintained.

A film barrier package according to one embodiment of the invention has an inner ply of a polymeric material, an outer ply of a polymeric material, and a substantially air free space disposed therebetween. Each of the two plies is formed of a sheet of polymeric material; these two plies may be formed of the same or different polymers. Their individual oxygen transmission rates should be approximately equal.

In some applications, the two plies may be formed by simply folding a single sheet of polymeric material to provide two plies adjacent one another and joined together along one edge thereof. In such a design, the inner and outer plies of the barrier may be sealed together, such as by heat sealing or the like, to fully define the anaerobic space therebetween—the space should not be open to the atmosphere.

The plies may be formed of any known polymer having sufficient barrier properties for use in packaging applications. Films currently used in the art include those made from polyester, polypropylene, PVDC, nylon, and polyethylene, as well as multi-layer laminate films formed of contiguous, bonded layers of these and other polymers. Any of these films may be advantageously used in the present invention. One of the goals of the invention, though, is to provide a particularly cost effective oxygen barrier for use in packaging applications. In order to further that end, in many situations it will be advantageous to use a cheaper polymeric film.

The thickness of these two plies of polymeric material may be varied as desired. It is contemplated that the thickness of each of these plies will be dependent on the particular application for which the barrier package of the invention is being used. This thickness may also depend upon the composition of the plies because, as explained above, the oxygen transmittance of a polymeric film will depend to a very large extent upon the material from which it is formed.

The present invention results not only in improved pet health and food acceptance, but in decreased production, storage, and transportation costs. Due to the high soluble fiber content and lower moisture level a greater quantity of pet food can be created per production run resulting in lower production costs. In addition, since the pet food can be placed directly into the container without the need for nitrogen flush, oxygen scavengers or vacuum sealing the production costs are also reduced. Storage and transportation costs are also reduced because there are no special temperature or humidity requirements. Transportation costs are also reduced because the containers of pet food have a longer shelf life which means larger quantities can be purchased per shipment thus reducing the shipping price per pound.

The combination of pet foods of the present invention free of adulterating preservatives, anti-oxidants, anti-mycotics, flavor agents and masking agents and moisturizer additives, and the barrier package produce a synergistic result never achieved before in the pet food industry. No all-natural, storable dog food has ever been developed that was as animal healthful without having to use canned storage or expensive oxygen free vacuum or inert gas packaging. As a result of this invention natural, healthy choice dog foods can be made which have long shelf life and avoid expensive, time-consuming packaging, heretofore used. As a result, unnatural, perhaps non-healthy food modifications previously used to escape package deficiencies can now be avoided.

It is to be understood that the application of the teachings of the present invention to a specific problem or environment will be within the capabilities of one having ordinary skill in the art in light of the teachings contained herein. The examples of the products and processes of the present invention appear in the following examples which are to be taken as illustrative but not limiting.

EXAMPLE 1

Water Activity and Oxidation Study

A study was conducted to determine the optimum amount of natural preservative, if any, the optimum type of pack-

aging material, and the optimum atmosphere within the container to insure maintained freshness, nutritional value, palatability and shelf life.

To prevent microbial growth and oxidation without the use of chemical preservatives, the following natural preservatives were put into the diet and evaluated:

(1) no preservatives (none);

(2) 0.5% (500 ppm) Naturox (Kemin Industries, Des Moines) which consists of mixed tocopherols, rosemary extract, citric acid and mono- and di-glycerides (N);

(3) 1% lauracedin, 5% lactic acid and 0.5% Naturox (1LLN); and

(4) 3% lauracedin, 5% lactic acid and 0.5% Naturox (3LLN). Lauracedin is a fatty acid shown to prevent microbial growth and whose activity is enhanced by the presence of lactic acid.

Four different types of packaging were considered in this study including two paper bags (AP and UC) that are routinely used in the pet food industry. The four bags consist of:

1. A 6 mil paper, 1 mil polyethylene bag, freely gas permeable (AP bag);

2. A 6 mil paper, 2 mil polyethylene bag, freely gas permeable (UC bag);

3. A moderately gas impermeable 48 gauge PET barrier bag with an oxygen transmission rate of 0.586 cc/100 sq inches/24 hours/atm (L bag); and

4. A gas impermeable foil bag with an oxygen transmission rate of less than 0.01 cc/100 square inches/24 hours/atm and with a one way valve that lets air out but not in (K bag).

The atmosphere in each of the bags was further modified by doing one of the following:

1. Nothing (Neither);

2. Nitrogen flush to reduce oxygen to below 2% before sealing the bag (N Flush);

3. Oxygen scavenger packet put into the bag before sealing it (O Scav); or

4. Both nitrogen flush and oxygen scavenger before sealing the bag (Both).

The food tested in the study was an organic ingredient containing adult dog diet consisting of flax seed meal, lentils, oat groates, peas, sunflower seed oil, canola seed meal, rice, dehydrated cane juice, yeast, sea kelp, calcium carbonate, salt, psyllium, and spirulina (listed in order of decreasing amount in the diet). It contained 20% crude protein, 15% crude fat, 8% moisture, 5% crude fiber and 5% ash.

Two samples of each of the preceding combination of factors (preservatives, packaging and atmosphere), which consisted of 112 samples, were used in the study. Each sample was evaluated for the amount of oxidation present by thiobarbituric acid (TBA) analysis one week after it was produced and packaged and again 4 months later. During this 4-month period the samples were stored at 37° C. and 85% relative humidity to induce the amount of oxidation that would occur during 12 months storage at room temperature and ambient humidity. The TBA analysis measures the concentration of malonaldehyde produced as a result of oxidation. Its concentration correlates best with the oxidation induced decrease in diet palatability, which is the first effect of food oxidation. Because of this, it is considered to be the best indication of shelf life stability. Following one year storage effects accelerated to 4 months, water activity was also measured as an indication of the diets susceptibility to microbial growth.

As shown in Tables 2, 3 and 4 the diet studied contained sufficient soluble fiber and other constituents to bind adequate water so that regardless of the preservatives, atmosphere or bags used, its water activity was sufficiently low to prevent microbial growth (<0.64) and was near that at which oxidation is minimized (0.4–0.5).

TABLE 2

Preservatives Effect on Water Activity on Pet Food From Gas Impermeable Bags Without An Altered Atmosphere

Preservatives	3LLN	1LLN	N	None
Water Activity	0.57	0.57	0.56	0.57

TABLE 3

Atmosphere Effect on Water Activity of Pet Food Containing Naturox From Gas Impermeable Bags

Preservatives	N Flush	O Scav	Both	Neither
Water Activity	0.51	0.60	0.58	0.56

TABLE 4

Bag Effect on Water Activity of Pet Food Containing Naturox With Nitrogen Flush and Oxygen Scavenger

Bag:	UC	AP	L	K
O Perm. cc/si/d	Freely	Freely	0.00585	<0.0001
Water Activity	0.66	0.58	0.65	0.56

As shown in Table 5 the amount of oxidation occurring in the food was directly related to the oxygen or gas permeability of the bag containing it. During the 12 month simulated study, the food in the freely permeable paper bags became highly oxidized, whereas no significant oxidation occurred in most gas impermeable bags.

TABLE 5

Bag Effect on Oxidation of Pet Foods as Indicated by Malonaldehyde (mg/kg) Formed in 4 months at 37° C. & 85% RH

Bag:	UC	PF	L	K
O Perm. cc/si/d	Freely	Freely	0.00586	<0.0001
M. aldehyde-mg/kg	6.1	5.3	0.6	0.1

As shown in Tables 6 and 7, none of the preservatives or altered atmospheres decreased oxidation. In gas permeable bags (UC & AP) oxidation was high whereas no oxidation occurred in food in the gas impermeable bags (K), whether it contained a preservative or not (Table 6). Altering the atmosphere in gas impermeable bags (K) isn't needed as no oxidation occurs regardless of the atmosphere. However, in moderately gas impermeable bags (L) when neither oxygen scavengers or nitrogen flush were used some oxidation occurred, which was prevented when either, or both, were used. (Table 7).

TABLE 6

Preservative Effect on Oxidation of Pet Food as Indicated by Malonaldehyde (mg/kg) Formed in 4 months at 37° C. and 85% RH

Bag	O Perm-ocs/d	Naturox only	Lauracedin & Lactate	No Pre-servatives
UC	Freely	8.1	7.09	3.9
AP	Freely	6.5	5.8	4.2
L	0.00586	1.7	1.0	1.0
K	<0.0001	~0.1	~0.1	0.0

TABLE 7

Atmosphere Effect on Oxidation of Pet Food as Indicated by Malonaldehyde (mg/kg) Formed in 4 months at 37° C. and 85% RH

Bag	O Perm-ocs/d	Oxygen Scav.	Nitrogen Flush	Both	Neither
UC	Freely	6.0	6.2	6.3	6.0
AP	Freely	5.3	5.7	5.3	5.0
L	0.00586	0.6	0.8	~0.2	1.3
K	<0.0001	~0.1	~0.1	~0.2	0.2

As shown in Table 8, there is inadequate unbound water in the pet food studied to allow any microbial growth to occur, and little or no oxidation occurred even without the use of preservatives, nitrogen flush, oxygen scavengers or vacuum packaging when the food was packaged in gas impermeable bags. Oxidation during the 12 month accelerated study was 2-times higher in moderately gas impermeable bags and 24 to 27-times higher in the freely gas permeable bags currently in common use in the pet food industry.

TABLE 8

Stability of Pet Food High in Soluble Fiber Without Preservatives, Nitrogen Flush, Oxygen Scavengers or Vacuum Packaging

Bag	UC	AP	L	K	Optimum
Ox. Perm-ocs/d/d	Freely	Freely	0.00586	<0.0001	0
Water Activity	0.66	0.58	0.65	0.56	0.6-0.4
Oxidation as indicated by malonaldehyde concentration (mg/kg of diet)					
1 wk after production	0.83	0.92	1.01	0.74	0
After 4 mo. storage*	5.45	5.06	1.34	0.91	0
During Storage	4.62	4.14	0.33	0.17	0

*at 37° C. and 85% RH which simulates the amount of oxidation that would occur in 12 months at room temperature and humidity.

EXAMPLE 2

Palatability Study

The effects of the methods used for pet food preservation on food palatability is of critical importance. Studies comparing palatability of dog food with preservatives (as described in Example 1) compared to dog food without preservatives were conducted. None of the preservatives tested effected diet palatability. Food containing no preservatives was preferred only 1.4 to 1 over the same dog food containing 0.5 Naturox, 3% lauracedin and 5% lactic acid. However, as shown in Table 9, bags had a profound effect on palatability. Table 9 contains the results of a two pan preference study conducted to determine the palatability of the same food put into different bags. The results are reported as the ratio of the mean percent that each of the two diets offered contribute to the total amount eaten by each of ten dogs at either 1 or 2 days feeding. For example, if dog 1 eats 30% diet A and 70% diet B, and dog 2 eats 10% diet A and 90% diet B, the mean is (10%+30%) divided by 2 dogs=20% diet A eaten, and 80% diet B eaten, for a preference ratio of B preferred over A by 80% to 20% or by 4 to 1. A preference ratio of less than 3 to 1 is not considered significant, i.e. indicates little or no difference in palatability between the two diets. The effect of the different types of bags on dry dog food palatability was determined in this study using both a dry extruded vegetarian dog food and a dry extruded poultry meal based dog food. Both types of dog food contained 0.5% Naturox. The atmosphere was not altered in any of the bags. As shown below, both the vegetarian dog food and the poultry meal based dog food from either of the two different types of gas impermeable bags were greatly preferred over the same diet from paper bags, whether the paper bags were poly lined or unlined. The difference occurred even though there was no difference in the amount of oxidation of the food in the gas impermeable bags from that in the paper bags.

The results in Table 9 show that, whether the dog food used was vegetarian based or poultry meal based, the dogs clearly preferred dog food contained in gas impermeable bags over that of dog food contained in paper bags (regardless of whether the paper bags were poly lined or unlined).

TABLE 9

Effects of Bags on Pet Food Palatability

Pet Food}	in	{Gas Imperm-eable bags}	{preferred over same diet in}	{Paper Bag}	by a	{Preference Ratio of}
Vegetarian		F		poly lined		17 to 1
Vegetarian		K		poly lined		123 to 1
Poultry meal		F		poly lined		10.5 to 1
Poultry meal		F		unlined		12.8 to 1

K = gas impermeable foil bag (Kaypac)
F = gas impermeable foil sandwiched between a layer of nylon and plastic (Fres-Co).

In light of Example 1 and Example 2, it is clear that the pet food with a high soluble fiber content and a lower water activity when contained in a gas impermeable bag demonstrates markedly increased shelf life, freshness, and palatability.

EQUIVALENTS

Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, many equivalents to the specific embodiments of the invention described specifically herein. Such equivalents are intended to be encompassed by the scope of the following claims.

What is claimed is:

1. A substantially gas impermeable container having at least two walls capable of forming an airtight seal that forms a substantially airtight space defined by the walls devoid of oxygen scavengers nitrogen fill, or vacuum conditions, and containing within the substantially airtight space a dry pet food having a moisture level in the approximate range of 5% to 15% by weight, soluble fiber content of greater than 3% by weight, and having a water activity within the range of 0.5 to 0.8 caused substantially by the soluble fiber content.

2. The container of claim **1** wherein the walls oxygen transmission rate is about 0.6 cc/100 sq. inches/24 hours/atm or less.

3. The container of claim **1** wherein the walls oxygen transmission rate is in a range of about 0.6-0.01 cc/100 sq. inch/24 hours/atm.

4. The container of claim **1** wherein the walls are of a composition that includes a polymer, plastic, aluminum foil, metal, or polymer/metal composite.

5. The composition of claim **4** wherein the polymer is selected from the group consisting of: polyvinylidene chloride, polyester, polypropylene, nylon and polyethylene.

6. The container of claim **1** further comprising a one-way valve that allows air to escape the sealed container but not enter the sealed container.

7. The dry pet food of claim **1** wherein the water activity is 0.7 or less.

8. The dry pet food of claim **1** wherein the soluble fiber content is above 3%.

9. The dry pet food of claim **1** including ingredients selected from the group consisting of: flax seed meal, lentils, oat groats, peas, sunflower seed oil, canola seed meal, rice, dehydrated cane juice, yeast, sea kelp, calcium carbonate, salt, psyllium and spirulina.

10. The dry pet food of claim **1** further comprising about 20% crude protein, about 15% crude fat, about 8% moisture, 5% crude fiber and 5% ash.

11. In combination, a dry pet food of a moisture level in the appropriate range of 5% to 15% by weight including an amount of natural edible fiber containing material so that soluble fiber content is about 3% to about 15% by weight which causes a water activity within the range of 0.5 to 0.8, and a surrounding and sealing gas impermeable barrier package devoid of oxygen scavengers, nitrogen fill or vacuum conditions.

12. The package combination of claim **11** which uses multiple layer construction of bonded film materials.

13. The package combination of claim **11** wherein the gas impermeable barrier package is a film and foil composite.

14. The container of claim **1** wherein the soluble fiber content is in the range of 5% to 12% by weight.

15. The method of decreasing deterioration of dry dog food comprising:

decreasing water activity to 0.8 or less by including in the dry dog food natural edible soluble fiber containing materials so soluble fiber content is greater than 3% by weight;

packaging the food in a substantially gas impermeable package devoid of oxygen scavengers, nitrogen fill or vacuum conditions.

16. The method of claim **15** wherein the step of minimizing water activity comprises including a greater than 3% by weight natural edible soluble fiber in the pet food.

17. The method of claim **15** wherein the step of minimizing oxidation comprises placing the pet food in a substantially gas impermeable barrier package.

18. The method of claim **15** wherein the step of minimizing oxidation rate by controlling water activity.

19. The method of claim **15** wherein the step of minimizing oxidation comprises controlling water activity.

20. Dry pet food made by the process comprising:

creating a dry pet food having a moisture level between 5% and 15% by weight, and including a natural edible soluble fiber material so that soluble fiber content is greater than 3% by weight;

placing the food into a surrounding and sealing gas impermeable barrier package devoid of oxygen scavengers, nitrogen filler, and vacuum conditions, so that water activity is 0.8 or less caused substantially by the natural edible soluble fiber material and oxidation is minimized because of the binding of water to the soluble fiber material and limitation on entry of oxygen into the package.

* * * * *

EXHIBIT F

US005340211A

United States Patent [19]

Pratt

[11] Patent Number: 5,340,211

[45] Date of Patent: Aug. 23, 1994

[54] **PROGRAMMABLE APPARATUS AND METHOD FOR DELIVERING MICROINGREDIENT FEED ADDITIVES BY WEIGHT**

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[73] Assignee: **Micro Chemical, Inc.,** Amarillo, Tex.

[21] Appl. No.: **154,636**

[22] Filed: **Nov. 17, 1993**

Related U.S. Application Data

[60] Continuation of Ser. No. 57,423, May 4, 1993, abandoned, which is a continuation of Ser. No. 835,037, Feb. 10, 1992, abandoned, which is a continuation of Ser. No. 455,242, Dec. 22, 1989, abandoned, which is a division of Ser. No. 311,336, Feb. 16, 1989, Pat. No. 4,889,433, which is a division of Ser. No. 137,501, Dec. 22, 1987, Pat. No. 4,815,042, which is a continuation-in-part of Ser. No. 833,904, Feb. 26, 1986, Pat. No. 4,733,971.

[51] **Int. Cl.**[5] **B01F 15/04**

[52] **U.S. Cl.** **366/141;** 222/57; 366/152; 414/12; 414/294

[58] **Field of Search** 366/141, 142, 140, 151, 366/152, 160, 161, 154, 18, 17, 19, 20, 21; 141/83, 104; 414/21, 294, 282; 222/37, 77, 58, 59

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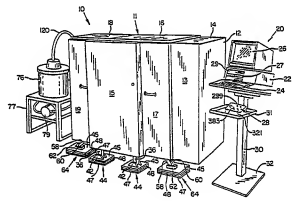
[57] **ABSTRACT**

A method and apparatus whereby livestock and poultry are administered feed additives in their feed ration. The apparatus stores additive concentrates separately until just prior to use, then on demand dispenses the additive concentrates into one or more weigh hoppers for weighing therein. The weighed contents of the weigh hoppers are discharged into a liquid carrier within a mixing vessel where the dispensed additives are diluted, suspended, and dispersed by mixing. The resulting carrier-and-additive slurry is pumped to a receiving station for mixing with a feed ration. The weighing components are isolated from movements that would affect additive weight determinations during the weighing process so that accurate measurements of additive weights are obtained. Dispensing and weighing of multiple additives within a single weigh hopper are sequential. Each additive may be weighed and discharged from the hopper individually or cumulatively with other additives. With multiple weigh hoppers, dispensing, weighing and discharge of additives from the different hoppers can occur simultaneously or independently. A programmable control can program the apparatuses for dispensing either entirely on a weight basis, partly on a weight basis and partly on a metering basis, on a weight-compensated metering basis, or entirely on a metering basis if the weighing means malfunctions.

53 Claims, 12 Drawing Sheets



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"Automated Pre–Mixed System", 1–page advertisement of Agra Products International, Inc. (undated).

"All–Digital Loss–in–Weight Feeding", pp. 4–5 from a K–tron Corporation publication (undated).

"System Responsibility . . . From Bulk Storage to the Precision Metering of Dry Materials", 5 pages, Acrison, Inc., publication.

"Prater Blue Streak Feed Processor, the Accurate One", 2 pages advertisement (undated).

"Weight Weight–Tronix's Revolutionary SFM–200 Radiation Master Stationary Feed Mixer", 2–page advertisment (undated).

Feed Management Magazine, vol. 37, No. 7, pp. 20,22 24, "Micro–Ingredient Control" (Jul. 1986).

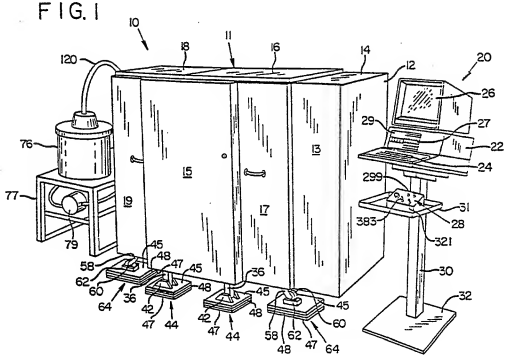
Various "Brewster" Weigh Machines As Demonstrated, Sold And Used In Approximately 1982–1985, As Disclosed In Materials Submitted In Related Application Ser. No. 07/455,242, Filed Dec. 22, 1989 And In Related Application Ser. No. 07/835,037, Filed Jan. 15, 1993, (A Continuation Of Application Ser. No. 07/455,242 (undated).

A Great Plains Volume Machine As Used More Than One Year Before The Priority Filing Date Of The Subject Application, As Disclosed In Materials Submitted In Related Application Ser. No. 07/455,242, Filed Dec. 22, 1989 And In Related Application Ser. No. 07/835,037, Filed Jan. 15, 1993 (A Continuation Of Application Ser. No. 07/455,242 (undated).

"The Hough Microweighing System", brochure of Hough Kenebec International, West Hartford, Connecticut (undated).

"Weigh–Tronix's Revolutionary SFM–200 Ration Master Stationary Feed Mixer", 2–page advertisement (undated).

FIG. 1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15
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299
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383
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321
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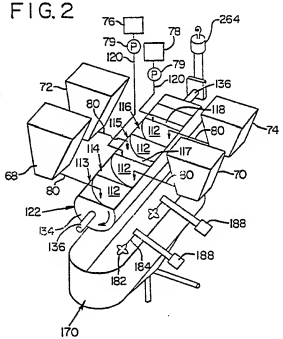
32

FIG. 2


76
78
264
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120
136
72
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182
170

FIG. 3

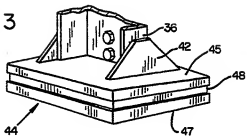
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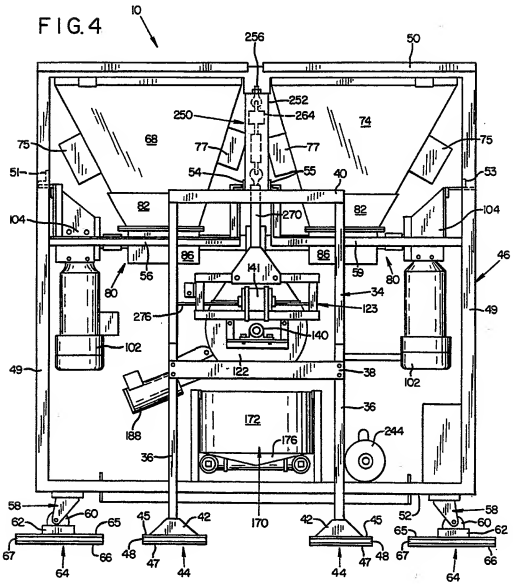
FIG. 4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256
50
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264
74
75
68
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77
75
51
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55
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53
82
270
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104
104
86
86
46
141
59
80
56
80
34
276
123
49
140
102
49
122
38
102
36
172
188
176
244
36
58
60
45
42
170
42
45
52
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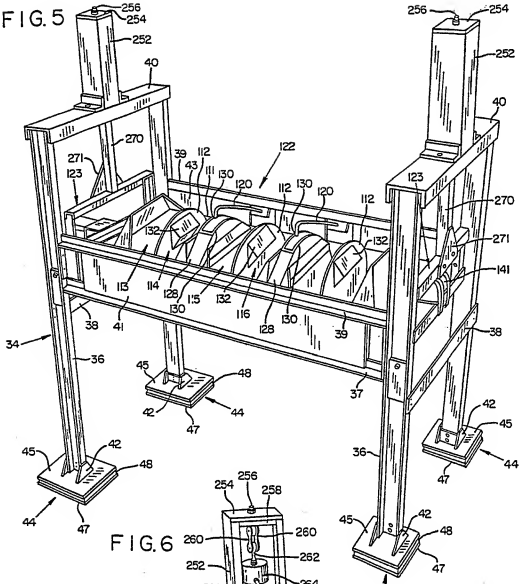
64
64

FIG. 5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111
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123
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132
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115
114
128
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128
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48
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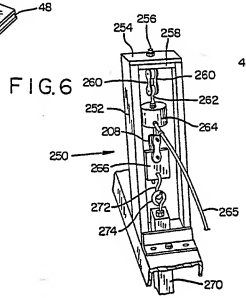
47
44

FIG. 6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260
262
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208
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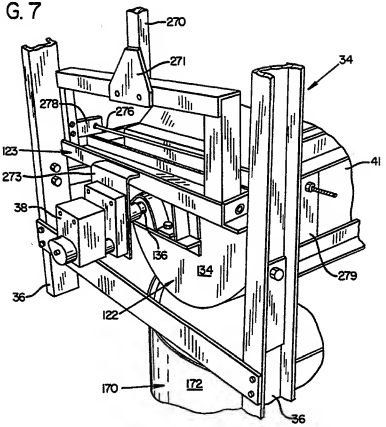
266
272
265
274
270

FIG. 7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279
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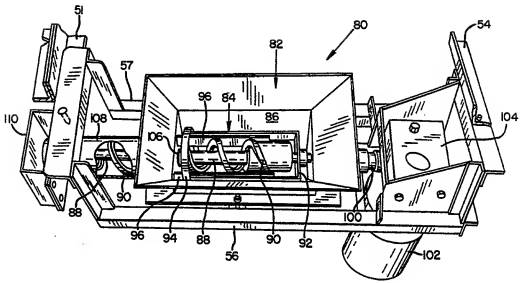
172
36

FIG. 8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80
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104
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100
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92
56
102

FIG. 9

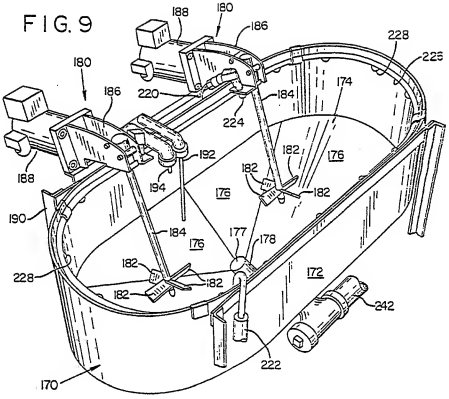


FIG. 10

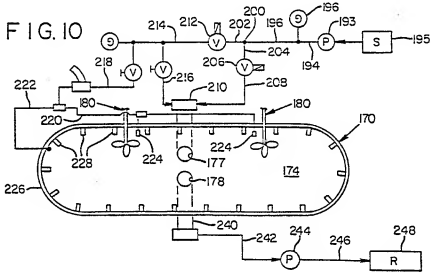


FIG. 11

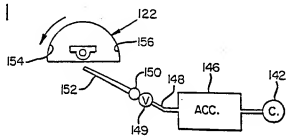


FIG. 12

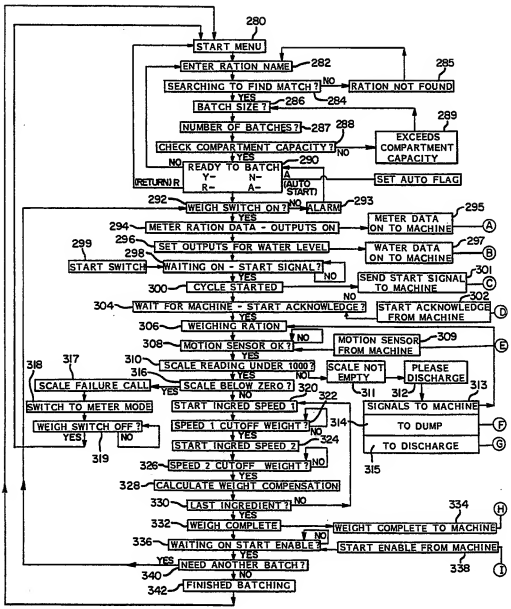
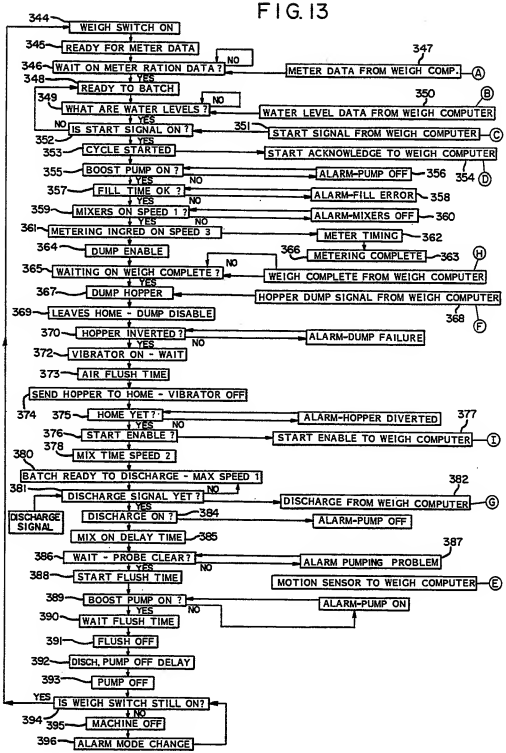

280
START MENU
ENTER RATION NAME
282
285
SEARCHING TO FIND MATCH ?
NO
RATION NOT FOUND
YES
BATCH SIZE ?
286
284
289
NUMBER OF BATCHES ?
287
288
CHECK COMPARTMENT CAPACITY ?
EXCEEDS COMPARTMENT CAPACITY
YES
NO
NO
READY TO BATCH
Y-
R-
N-
A-
290
A
(AUTO START)
RETURN R
SET AUTO FLAG
292
WEIGH SWITCH ON ?
NO
ALARM
293
YES
295
METER RATION DATA - OUTPUTS ON
METER DATA ON TO MACHINE
A
294
296
299
SET OUTPUTS FOR WATER LEVEL
WATER DATA ON TO MACHINE
297
B
298
START SWITCH
WAITING ON - START SIGNAL ?
NO
SEND START SIGNAL TO MACHINE
301
C
YES
300
CYCLE STARTED
302
NO
304
WAIT FOR MACHINE - START ACKNOWLEDGE ?
START ACKNOWLEDGE FROM MACHINE
D
YES
306
WEIGHING RATION
NO
308
MOTION SENSOR OK ?
MOTION SENSOR FROM MACHINE
309
E
YES
318
317
310
SCALE READING UNDER 1000 ?
SCALE NOT EMPTY
PLEASE DISCHARGE
316
YES
NO
311
312
313
SCALE FAILURE CALL
SCALE BELOW ZERO ?
320
322
YES
NO
SWITCH TO METER MODE
START INGRED SPEED 1
SIGNALS TO MACHINE
WEIGH SWITCH OFF ?
SPEED 1 CUTOFF WEIGHT ?
314
TO DUMP
F
YES
NO
NO
324
START INGRED SPEED 2
TO DISCHARGE
G
319
326
SPEED 2 CUTOFF WEIGHT ?
NO
315
YES
328
CALCULATE WEIGHT COMPENSATION
330
LAST INGREDIENT ?
NO
334
H
YES
332
WEIGH COMPLETE
WEIGHT COMPLETE TO MACHINE
NO
336
WAITING ON START ENABLE ?
START ENABLE FROM MACHINE
YES
338
I
NEED ANOTHER BATCH ?
YES
340
NO
342
FINISHED BATCHING

FIG. 13


344 WEIGH SWITCH ON
345 READY FOR METER DATA
346 WAIT ON METER RATION DATA ?
NO
YES
347 METER DATA FROM WEIGH COMP. A
348 READY TO BATCH
349 WHAT ARE WATER LEVELS ?
NO
YES
350 WATER LEVEL DATA FROM WEIGH COMPUTER B
351 IS START SIGNAL ON ?
NO
YES
START SIGNAL FROM WEIGH COMPUTER C
352 CYCLE STARTED
START ACKNOWLEDGE TO WEIGH COMPUTER
353 BOOST PUMP ON ?
YES
NO
ALARM-PUMP OFF 356
354 D
355 FILL TIME OK ?
YES
NO
ALARM-FILL ERROR 358
357 MIXERS ON SPEED 1 ?
YES
NO
ALARM-MIXERS OFF 360
359 METERING INGRED ON SPEED 3
YES
NO
METER TIMING 362
361 DUMP ENABLE
364 WAITING ON WEIGH COMPLETE ?
NO
YES
366 METERING COMPLETE 363 H
WEIGH COMPLETE FROM WEIGH COMPUTER
365 DUMP HOPPER
367 LEAVES HOME - DUMP DISABLE
HOPPER DUMP SIGNAL FROM WEIGH COMPUTER
368 F
369 HOPPER INVERTED ?
YES
NO
ALARM-DUMP FAILURE
370 VIBRATOR ON - WAIT
372 AIR FLUSH TIME
373 SEND HOPPER TO HOME - VIBRATOR OFF
374 HOME YET ?
YES
NO
ALARM-HOPPER DIVERTED 377
375 START ENABLE ?
START ENABLE TO WEIGH COMPUTER I
376 MIX TIME SPEED 2
378 BATCH READY TO DISCHARGE - MAX SPEED 1
380 DISCHARGE SIGNAL YET ?
NO
YES
382 DISCHARGE FROM WEIGH COMPUTER G
381 DISCHARGE ON ?
DISCHARGE SIGNAL
384 ALARM-PUMP OFF
MIX ON DELAY TIME 385
WAIT - PROBE CLEAR ?
YES
NO
387 ALARM PUMPING PROBLEM
386 START FLUSH TIME
MOTION SENSOR TO WEIGH COMPUTER E
388 BOOST PUMP ON ?
YES
NO
ALARM-PUMP ON
389 WAIT FLUSH TIME
390 FLUSH OFF
391 DISCH. PUMP OFF DELAY
392 PUMP OFF
393 IS WEIGH SWITCH STILL ON?
YES
NO
394 MACHINE OFF
395 ALARM MODE CHANGE
396

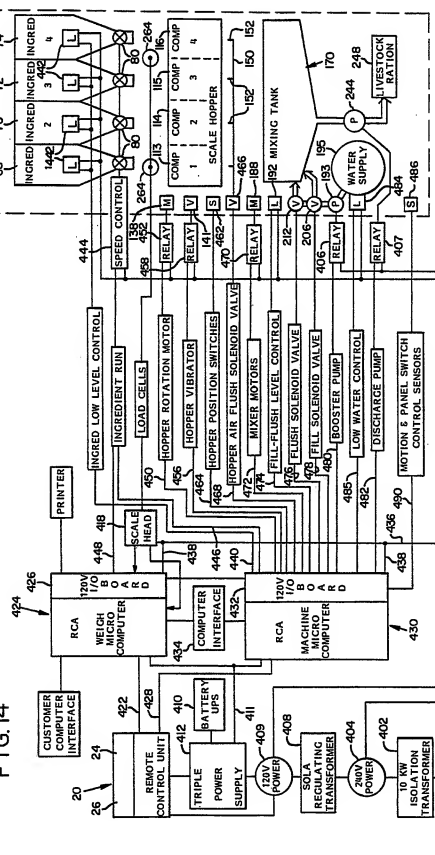

INGRED 1
INGRED 2
INGRED 3
INGRED 4
COMP 1
COMP 2
COMP 3
COMP 4
SCALE HOPPER
MIXING TANK
WATER SUPPLY
LIVESTOCK RATION
SPEED CONTROL
INGRED LOW LEVEL CONTROL
INGREDIENT RUN
LOAD CELLS
HOPPER ROTATION MOTOR
HOPPER VIBRATOR
HOPPER POSITION SWITCHES
HOPPER AIR FLUSH SOLENOID VALVE
MIXER MOTORS
FILL-FLUSH LEVEL CONTROL
FLUSH SOLENOID VALVE
FILL SOLENOID VALVE
BOOSTER PUMP
LOW WATER CONTROL
DISCHARGE PUMP
MOTION & PANEL SWITCH CONTROL SENSORS
PRINTER
SCALE HEAD
RELAY
RCA WEIGH MICRO COMPUTER
RCA MACHINE MICRO COMPUTER
120V I/O BOARD
COMPUTER INTERFACE
CUSTOMER COMPUTER INTERFACE
REMOTE CONTROL UNIT
TRIPLE POWER SUPPLY
BATTERY UPS
120V POWER
SOLA REGULATING TRANSFORMER
240V POWER
10 KW ISOLATION TRANSFORMER
480V POWER SUPPLY

FIG. 14

FIG. 15

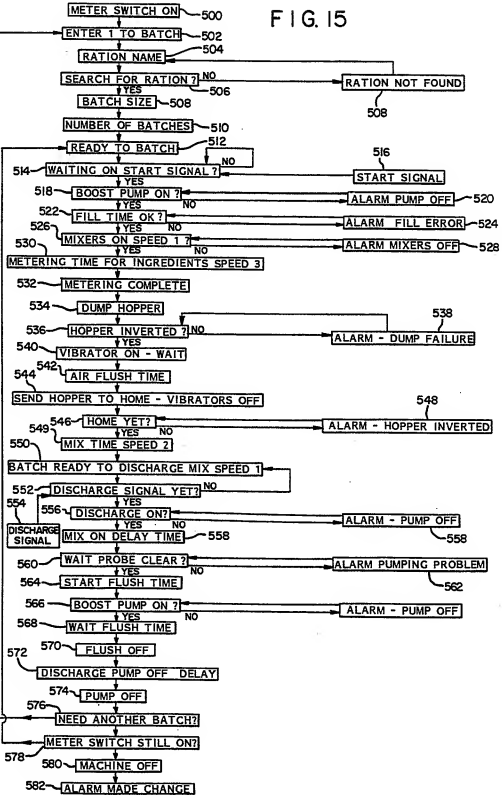
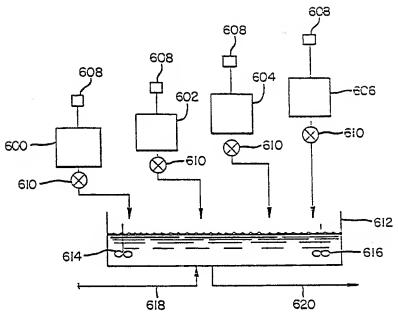

METER SWITCH ON
500
ENTER 1 TO BATCH
502
RATION NAME
504
SEARCH FOR RATION ?
NO
RATION NOT FOUND
508
YES
506
BATCH SIZE
508
NUMBER OF BATCHES
510
READY TO BATCH
512
NO
516
514
WAITING ON START SIGNAL ?
START SIGNAL
YES
518
BOOST PUMP ON ?
ALARM PUMP OFF
520
YES
NO
522
FILL TIME OK ?
ALARM FILL ERROR
524
YES
NO
526
MIXERS ON SPEED 1 ?
ALARM MIXERS OFF
528
530
YES
NO
METERING TIME FOR INGREDIENTS SPEED 3
532
METERING COMPLETE
534
DUMP HOPPER
538
536
HOPPER INVERTED ?
NO
ALARM - DUMP FAILURE
YES
540
VIBRATOR ON - WAIT
542
544
AIR FLUSH TIME
SEND HOPPER TO HOME - VIBRATORS OFF
548
546
HOME YET?
549
ALARM - HOPPER INVERTED
YES
NO
550
MIX TIME SPEED 2
BATCH READY TO DISCHARGE MIX SPEED 1
552
DISCHARGE SIGNAL YET?
NO
YES
554
556
DISCHARGE ON?
ALARM - PUMP OFF
YES
NO
DISCHARGE SIGNAL
MIX ON DELAY TIME
558
558
560
WAIT PROBE CLEAR ?
ALARM PUMPING PROBLEM
YES
NO
564
START FLUSH TIME
562
566
BOOST PUMP ON ?
ALARM - PUMP OFF
YES
NO
568
WAIT FLUSH TIME
572
570
FLUSH OFF
DISCHARGE PUMP OFF DELAY
574
PUMP OFF
576
NEED ANOTHER BATCH?
METER SWITCH STILL ON?
578
580
MACHINE OFF
582
ALARM MADE CHANGE

FIG. 16


608
608
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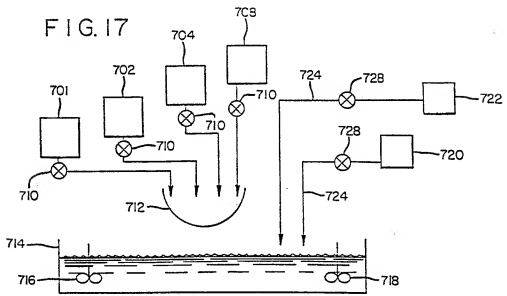
616
618
620

FIG. 17


708
704
702
701
724
728
710
722
710
710
728
720
710
712
724
714
716
718

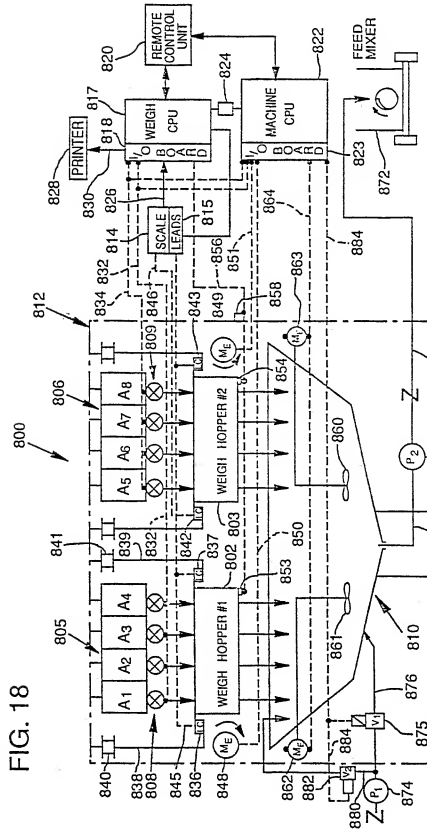
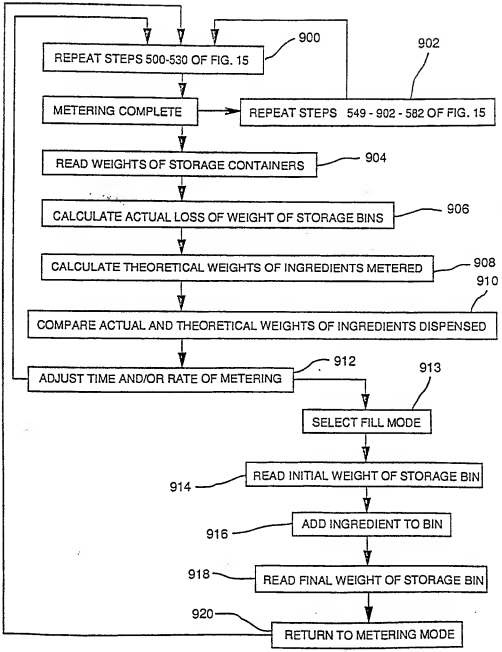

REMOTE CONTROL UNIT
820
WEIGH CPU
817
I/O BOARD
818
PRINTER
828
MACHINE CPU
822
824
FEED MIXER
823
872
826
830
SCALE LEADS
815
814
856
851
832
834
812
846
809
843
849
858
863
884
800
806
A8
A7
A6
A5
WEIGH HOPPER #2
803
854
860
870
868
841
839
832
842
837
802
853
850
866
805
A4
A3
A2
A1
WEIGH HOPPER #1
861
810
876
875
840
838
808
845
836
848
862
882
880
874
Z
P1
P2
V1
V2
M1
M2
ME
LC

FIG. 18

FIG. 19


REPEAT STEPS 500-530 OF FIG. 15
900
902
METERING COMPLETE
REPEAT STEPS 549 - 902 - 582 OF FIG. 15
READ WEIGHTS OF STORAGE CONTAINERS
904
CALCULATE ACTUAL LOSS OF WEIGHT OF STORAGE BINS
906
CALCULATE THEORETICAL WEIGHTS OF INGREDIENTS METERED
908
910
COMPARE ACTUAL AND THEORETICAL WEIGHTS OF INGREDIENTS DISPENSED
912
ADJUST TIME AND/OR RATE OF METERING
913
SELECT FILL MODE
914
READ INITIAL WEIGHT OF STORAGE BIN
916
ADD INGREDIENT TO BIN
918
READ FINAL WEIGHT OF STORAGE BIN
920
RETURN TO METERING MODE

PROGRAMMABLE APPARATUS AND METHOD FOR DELIVERING MICROINGREDIENT FEED ADDITIVES BY WEIGHT

This application is a continuation of application Ser. No. 08/057,423, filed May 4, 1993, now abandoned, which is a continuation of application Ser. No. 07/835,037, filed Feb. 10, 1992, now abandoned, which is a continuation of application Ser. No. 07/455,242, filed Dec. 22, 1989, now abandoned, which is a division of application Ser. No. 07/311,336, filed Feb. 16, 1989, now U.S. Pat. No. 4,889,433, which is a division of application Ser. No. 07/137,501, filed Dec. 22, 1987, now U.S. Pat. No. 4,815,042, which is a continuation-in-part of application Ser. No. 06/833,904, filed Feb. 26, 1986, now U.S. Pat. No. 4,733,971.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the administering of feed additives to livestock, and more particularly to a method and apparatus for supplementing the diets of livestock and poultry with feed additives such as nutrients and medicines supplied in a consumptive fluent carrier such as water.

2. General Discussion of the Background

It has long been a common practice to feed additive supplements to cattle and other livestock, including poultry. Such supplements include vitamins, minerals, proteins, enzymes, hormones, antibiotics, worm medicines, and other nutritional supplements and medications, which provide a balanced diet, protect the livestock from disease, and stimulate growth.

An early method of feeding additives to livestock involved the use of commercially prepared additive premixes. The additives were premixed together in dry form, with some dry diluting filler material, and then stored at the feedlot for a period of time until ready for use. The premix was either mixed with the feed ration before delivery to the animals or spread on the feed at the feed trough. Premixes suffer the drawbacks of being costly to buy, store and administer. They are difficult to mix evenly with the feed, and additives of different densities tend to segregate in premixes, increasing the chances that specific animals will receive too much or too little of a given additive. Too much of especially toxic additives can have dangerons or even lethal consequences.

Additives also tend to lose their potency in premixes through physical or chemical breakdown, especially if stored for a long period of time under changing environmental conditions in combination with other additives. Therefore, there is no assurance that livestock receive their intended dosages of specific additives when the additives are administered in premixes.

Premixes also limit the choices of additive combinations that livestock feeders can feed their animals to those combinations available commercially. They also limit a feedlot's flexibility to feed different groups of animals different combinations and dosages of additives to meet their differing needs.

Many of the foregoing problems were solved by the methods and apparatus of U.S. Pat. Nos. 3,437,075; 3,498,311; 3,822,056; 3,670,923; and 3,806,001, which are commonly assigned to the owner of the present application. These patents disclose various methods and apparatus for separately dispensing at the feedlot, separately stored livestock feed additive concentrates into a flow of fluent carrier material for dilution, dispersion and suspension, and for transporting the resulting slurry into livestock drinking water or feed rations shortly before the time of intended consumption. Each of these methods and apparatus, however, meter the desired amount of each feed additive on a volumetric basis. Volumetric metering can be inaccurate because of changes in the densities of additive concentrates caused by variations in humidity, particle size, moisture content, flow characteristics, temperature, oil content and other factors. Even minor inaccuracies in the amount of additive concentrates dispensed can cause serious problems, since some of the additives are very potent, toxic drugs. Typically, only 10 to 100 grams of a given additive concentrate are dispersed in a ton of feed. Volumetric metering is only accurate to within 1–2% even under the best of conditions.

Therefore, there is a need for a more accurate method and means for dispensing additive concentrates in systems for delivering additives into feed rations at the feedlot, just before the time of intended consumption of the ration. One potentially more accurate approach is to dispense additive concentrates by weight rather than volume. It is believed that at least one weigh-type additive concentrate delivery system has been tried, but unsuccessfully. It is believed that such system weighed and then dispensed each additive separately and sequentially. It is believed that such system was unsuccessful because it was too slow and too inaccurate for handling additive concentrates in a feedlot environment.

U.S. Pat. No. 2,893,602 and U.S. Pat. No. 3,595,328 disclose machines for weighing batch amounts of aggregate mixtures such as asphalt. Each of these machines uses a scale or strain gauge to measure the amount of bulk material dispensed from a storage container. These systems are only suitable, however, for making the gross kinds of measurements needed in dispensing the mixing bulk materials such as aggregates for making asphalt or concrete, and feed grains for making feeds in commercial feed mills. The weighing components of these machines, for example, are not able to weigh gram amounts of materials as would be required for additive concentrate dispensing in feedlots. Even if they were able to make such fine measurements, their scales would be affected by environmental conditions commonly found at feedlots such as wind and movement of machine components that would adversely affect their accuracy to an unacceptable extent. Finally, these devices would lose accuracy progressively because of a buildup of residue of aggregate particles in their weighing containers during use. They would therefore be unsuitable for dispensing additive concentrates in a feedlot environment.

Accordingly, a primary object of the present invention is to provide a new and improved method and means for dispensing and delivering feed additive concentrates in various combinations and dosages to livestock using primarily weight-controlled rather than volumetric dispensing of additive concentrates.

Another primary object is to provide a new and improved method and apparatus for dispensing and delivering combinations of feed additive concentrates in a liquid slurry to a livestock feed ration at feedlots which is more accurate than prior such methods and apparatus.

Another object is to provide a method and apparatus as aforesaid which can be operated selectively either on a weight or volumetric basis.

Another object is to provide a method and apparatus as aforesaid that can be used effectively in a feedlot environment.

Still another object is to provide such an apparatus and method with an improved control system that can be controlled by a central processing unit that can be quickly and conveniently programmed to meet the varying needs of a given feedlot and different feedlots.

Another object is to provide a method and apparatus that are flexible in enabling the dispensing and weighing of two or more additives either simultaneously or cumulatively, or both, and in enabling the discharge of each weighed additive into a diluting liquid carrier either individually before other additives are weighed or together with other weighed additives.

Finally, it is a specific object of the invention to provide a method and apparatus as aforesaid which can accurately dispense gram amounts of potent microingredient additive concentrates to accuracies within 0.5 grams.

SUMMARY OF THE INVENTION

The aforementioned objects are achieved by providing a method and apparatus for measuring, dispensing, and delivering different combinations and proportions of microingredient feed additive concentrates on primarily a weight basis in small but accurate amounts, into a liquid carrier. The carrier and concentrates form a slurry which is delivered into a livestock or poultry feed ration shortly before the feed ration is delivered to the animals for consumption. The apparatus includes multiple dry and liquid additive concentrate storage means for storing the various additive concentrates separately at the feedlot. A plurality of separate dispensing means, such as conveyor screws for the dry additives and pumps for the liquid additives, dispense separately and without intermingling the additive concentrates from each of the storage means into a receiving means such as separate compartments of a hopper or multiple weigh hoppers. Weighing means are provided for determining the weights of the different additives dispensed and for stopping the dispensing of each additive when a predetermined weight of that additive has been dispensed. The weigh means, for example, may comprise a weigh scale means supporting each weigh hopper or supporting the storage means.

In a preferred embodiment shown and described, the weigh hopper is scale-mounted, and the additives are dispensed and weighed sequentially and cumulatively as they are added to the weigh hopper. Isolating means isolate the weighing means from movements affecting its weighing function so that accurate weight determinations are obtained. A control means, such as a central processing unit, controls separately the operation of each dispensing means to dispense a given microingredient additive from a given storage means until a predetermined weight of that microingredient has been dispensed and weighed. When all selected additive concentrates have been dispensed into the weigh hopper and weighed, the hopper deposits its contents into a liquid carrier within another portion of the receiving means comprising a mixing vessel. The liquid carrier and additive concentrates are intermixed in the mixing vessel to dilute, dispense and suspend the additives in a liquid slurry. The slurry is then delivered to a receiving station where it is either sprayed directly into and mixed with a feed ration or held for subsequent addition to a feed ration.

The control means of the apparatus includes means for operating the apparatus either in a weigh mode, or, for example, if the weigh means is inoperative, in a volumetric dispensing mode.

The control means may include a programmable controller, programmable to cause the apparatus to dispense microingredients either entirely on a weight basis, partly on a weight basis and partly on a volumetric (metering) basis, on a weight-compensated metering basis, or entirely on a metering basis if, for example, the weighing means malfunctions.

The isolation means may include a separate, independently mounted and isolated weigh subframe assembly for the weighing components of the apparatus. Within the subframe assembly, scale components may be further isolated from other components. Further isolation may be provided by an independent main frame surrounding the subframe and protecting it from external forces by protective panels.

The weigh means may include multiple weigh hoppers, each for weighing one or more different additives. Different additives may be dispensed into the multiple weigh hoppers and weighed simultaneously to speed up the makeup of a batch formulation of additives. Where multiple additives are dispensed into each weigh hopper, the hopper may be discharged after each additive is weighed or only after all additives are weighed cumulatively.

Where multiple weigh hoppers are used, each includes its own independent weighing means to enable weighing of multiple additives to occur simultaneously. Each weighing means includes a scale head that takes a weight reading many times per unit of time, averages such readings, and then transmits the averaged reading to the central processing unit only once during the same unit of time, thereby minimizing the effects of any erroneous weight reading induced by extraneous or other transient factors.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the present invention will become more apparent from the following detailed description which proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a perspective view showing the major components of an apparatus in accordance with the present invention.

FIG. 2 is a schematic perspective view illustrating the internal components of the main cabinet shown in FIG. 1.

FIG. 3 is an enlarged, perspective view of a typical foot portion and isolation pad of a support leg of the apparatus of FIG. 1.

FIG. 4 is an enlarged, front elevational view of the main cabinet shown in FIG. 1, the cabinet panels having been removed to show the internal parts of the machine.

FIG. 5 is an enlarged, perspective view of the weigh frame subassembly of the apparatus shown in FIG. 4.

FIG. 6 is an enlarged, fragmentary, perspective view of a load cell in a weigh tower of the weigh frame of FIG. 5, the remainder of the weigh frame being broken away.

FIG. 7 is an enlarged, fragmentary perspective view of a portion of the weigh hopper subassembly of the weigh frame shown in FIG. 5.

FIG. 8 is a fragmentary top perspective view of a dry additive dispensing means portion of the apparatus of FIG. 4, shown mounted on the main frame assembly of FIG. 4;

FIG. 9 is a fragmentary top perspective view of the mixing vessel and associated components of the main frame assembly shown in FIG. 4;

FIG. 10 is a plumbing diagram for the fluid components of the apparatus of the preceding figures;

FIG. 11 is a schematic view of the air flush system for the weigh hopper portion of the apparatus;

FIG. 12 is a flow diagram illustrating the logic of a computer program which controls the weigh means of the present apparatus.

FIG. 13 is a flow diagram illustrating the logic of a computer program which controls all machine operating sequences and functions other than the weigh functions illustrated in FIG. 12.

FIG. 14 is an electrical control schematic diagram for the illustrated apparatus.

FIG. 15 is a flow diagram illustrating the logic of a computer program which controls alternative volumetric metering and dispensing functions of the illustrated apparatus;

FIG. 16 is a schematic view illustrating a first alternative embodiment of the invention in which microingredient additive concentrates are dispensed directly into a mixing vessel from individually weighed storage containers.

FIG. 17 is a schematic view illustrating a second alternative embodiment of the invention in which dry additive concentrates are dispensed by weight into a weigh hopper while liquid additive concentrates are metered by volume directly into the mixing vessel.

FIG. 18 is a schematic view showing a third alternative embodiment of the invention in which different additive concentrates can be dispensed into different weigh hoppers simultaneously and the different weigh hoppers discharged either independently or simultaneously and either after the weighing of each additive or cumulatively after the cumulative weighing of multiple additives in each hopper.

FIG. 19 is a flow diagram illustrating the logic of a modification of the computer program of FIG. 15 which controls a hybrid volumetric-weight system of measuring the amounts of microingredients dispensed using apparatus of the general type shown in FIG. 16.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Introduction

The microingredient feed additive concentrates of the present invention include such potent substances as hormones, antibiotics, and vitamins that are typically administered to cattle and poultry at feeding operations, such as cattle feedlots, in gram amounts or less. It is often essential that a prescribed amount of a microingredient be delivered to an animal, and no more. Too little of a microingredient has no effect, while too much of it may be toxic or fatal. The range between too much or too little of some additives is often no more than 0.5 gram. The apparatus and method disclosed in this detailed description is intended to accurately dispense dry and liquid additive concentrates within this range of accuracy.

General Assembly

With reference to the drawings, FIG. 1 illustrates an apparatus shown generally at 10 for measuring, dispensing, and delivering microingredient feed additive concentrates in small but accurate proportions in a liquid carrier slurry to livestock shortly before delivery of the feed ration to the animals for consumption. The apparatus 10 includes several separate components including a main cabinet 11, and a remote control unit 20, shown for convenience near cabinet 11 but normally located at a remote control station such as at a feed truck filling station in a feedlot. Additional separate components include multiple liquid additive concentrate storage containers 76, 78 (only one being shown in FIG. 1) supported on a stand 79, and their dispensing pumps 79 (see FIG. 2). Typically, a separate water supply tank 195 (FIG. 14) supplies the necessary carrier and flush water to the cabinet through fill and flush conduits (FIG. 10), via a booster pump 193 (FIG. 14).

Another separate cabinet (not shown) houses a weigh micro computer, or central processing unit, shown schematically at 424 in FIG. 14. A second microcomputer, or central processing unit, shown schematically at 430 in FIG. 14, for controlling the machine sequencing and volumetric metering functions, is housed within one end portion 13 of cabinet 11. Various speed controls and electrical relay interfaces and circuitry of the control system shown in FIG. 14 are also housed within cabinet end portion 13. Such end portion is a separate compartment of cabinet 11 that can be swung open about a hinged vertical axis for access.

Cabinet 11 houses the major mechanical components of the apparatus. The exterior of the cabinet, with its protective panels 12, completely encloses and shields such components from external dust, dirt and other contaminants common in a feedlot environment. The panels also protect the internal components, especially the weight-sensitive ones, from external forces such as wind, jarring contact, and the like, that would otherwise affect the accuracy of weight measurements.

Referring to FIG. 4 showing the major components inside the cabinet 11, such components include a main frame 46 and an entirely separate and independently mounted subframe 34, each mounting certain components. Access to the components mounted on these frames is gained through access doors 15, 17, 19 in a front wall of the cabinet 11, and through hinged lids 16, 18 on a top wall of the cabinet.

In general, weigh subframe 34 mounts those components which are necessary to the weighing function of the apparatus, and main frame 46 mounts the remaining components that could, during their operation, induce undesirable movements in the weigh components to adversely affect the weighing function. Accordingly, the weigh subframe serves as a means for isolating the weight components from internal machine movements induced through operation of components on the main frame.

The main frame components include storage bins 68, 70, 72, 74 for storing different dry additive concentrates, dry additive dispensing means 80 for dispensing additives from the storage bins, and an additive-receiving means comprising a mixing vessel or tank 170. Other main frame-mounted components include a discharge pump 244 for pumping slurry from mixing vessel 170, slurry mixers 180, and various plumbing components for supplying carrier and flush water to the mixing

vessel and discharging slurry liquid from the vessel. Cabinet lids **16, 18** provide access to the storage bins for refilling them.

The subframe **34** includes an entire subassembly of weigh components, including a weigh hopper means comprising the compartmented weigh hopper **122**, and a suspension means for suspending the weigh hopper from a weighing means **250**. The suspension means includes a pair of suspension frames **123**, one at either end of the weigh hopper. Each such frame rotatably supports weigh hopper **122**. Each suspension frame **123** includes a suspension arm **270** suspending the suspension frame from the weigh means **250**. The weigh means includes, at each end of the subframe **34**, a weigh tower **252** projecting upwardly from the subframe and suspending therein a load cell **264**. The load cell in turn suspends the weigh hopper through an appropriate connection to suspension arm **270** of suspension frame **123**.

Remote control unit **20** includes a computer terminal **22** supported on a stand **30** having a base plate **32**. Terminal **22** includes a primary keyboard **24**, a primary display screen **26**, a small, secondary keyboard **27** and a small, secondary display screen **29**. Various control switches and indicators are provided on a control switch box **28** mounted on a shelf **31** of the stand below the terminal **22**.

Weigh Frame Subassembly

Apparatus **10** is seen therein and in FIG. **5** to comprise a weigh frame **34** having four uprights **36** and two each of parallel crossbeams **38, 40** and longitudinal beams **37, 39** rigidly interconnecting the four uprights **36**. A vertical slat **41, 43** is carried between each pair of beams **37, 39**. Each of uprights **36** has an enlarged foot **42** to enhance the stability of weigh frame **34**. Each foot **42** is mounted on an elastomeric isolation pad **44** (FIG. 3) which absorbs vibrations or other environmental influences that may affect the accuracy of the functions performed by weigh frame **34**. Each pad **44** includes a square upper plate **45** to which foot **42** is secured, the upper plate having a peripheral, downwardly depending flange which forms an enclosure. A square lower plate **47** is attached to a floor with bolts below plate **45** and has a peripheral, upwardly extending flange that forms an enclosure. A rubber cushion **48** is placed between plates **45, 47** within the enclosures formed by the flanges on the plates. Cushion **48** is thick enough to maintain the upwardly and downwardly extending flanges in spaced relationship so that vibrations are not communicated between plates **45, 57**.

Main Frame Subassembly

Separate mounting or main frame **46** substantially surrounds weigh frame **34**, the mounting frame **46** comprising four uprights **49** interconnected by four top support beams **50** and four bottom support beams **52**. Two intermediate parallel support beams **51, 53** extend across opposing parallel faces of frame **46**, and two parallel support beams **54, 55** extend across the middle of frame **46** parallel to beams **51, 53**. A pair of parallel, U-shaped brackets **56, 57** are fixed to and suspend from beams **51, 54** (FIG. **8**), and a pair of similar U-shaped brackets are fixed to and suspend from beams **53, 55**. Only one U-shaped bracket **59** is shown in FIG. **4**, although it will be understood that a second, parallel U-shaped bracket extends between beams **53, 55** in an arrangement similar to that shown in FIG. **8** for U-shaped brackets **56, 57**.

Mounting frame **46** is supported by casters **58** each having a roller **60** that is received within a cup **62** that is attached to an isolation pad **64** which is similar in structure to pad **44** shown in FIG. **3**. Pad **64** comprises a top plate **65** having a peripheral, downwardly depending flange and a bottom plate **66** bolted to the floor and having a peripheral, upwardly extending flange. A rubber cushion **67** is positioned between plates **65, 66** within the enclosures formed by their peripheral flanges, the width of cushion **67** being great enough to keep the peripheral flanges in spaced relationship to one another and avoid metal to metal contact which might transfer vibrations.

FIGS. **2** and **4** show multiple storage means such as dry additive concentrate storage bins **68, 70, 72,** and **74** for storing separately a plurality of different dry microingredient feed additive concentrates. Each of the bins has a square top opening and square bottom opening, the bottom opening having a smaller area than the top opening such that the cross-sectional area of each bin diminishes in the direction of the bottom opening. A pair of vibrator motors **75, 77** (FIG. **4**) are placed on each bin **68–72** to assist in moving dry microingredient concentrates out of the bins during dispensing.

A plurality of liquid containers **76, 78** are also shown in FIG. **2** for storing separately different liquid microingredient feed additive concentrates. The liquid containers are supported on a table **79** (FIG. **1**) adjacent cabinet **11** and connected to the apparatus through flexible tubes described later.

A separate dry dispensing means **80** is provided for each dry bin **68–74**. A separate liquid dispensing means **120** is provided for each liquid container **76–78**. Each liquid and dry dispensing means is independently operated and controlled for dispensing separately several selected additive concentrates from their respective bins and liquid containers in predetermined weights during a machine operating cycle.

One of the dry dispensing means **80** for a dry microingredient is shown best in FIGS. **4** and **8**. It includes an annular collar **82** having a square cross section. The collar fits closely about the open bottom of a bin **68–74** and extends partially up its sidewalls. Collar **82** has a square frusto-pyramidal configuration which defines a flow passageway of progressively decreasing cross section from the bottom bin opening to a top opening into a coreless metering screw assembly **84** within a rectangular lower extension section **86** of collar **82** having a curved bottom. Screw assembly **84** includes a rotatable core **88** which carries a helical metal screw **90** and rectangular screw agitator **92** with a circular band **94** around one end thereof. A stationary rear one-half tube extension **96** of a conveyor tube **108** projects into the interior of agitator **92** to start the conveyance of material that is moved by the screw **90** into conveyor tube **108**. Agitator **92** helps maintain a uniform microingredient density around rotating screw **90**.

Agitator **92** is rotated by a shaft **100** which is driven through a right-angle gear box **104** by a variable-speed motor **102**, with three pre-set speeds. Core **88** and screw **90** project through opening **106** and into conveyor tube **108** having an open end that terminates adjacent a deflection plate **110** above the top opening of weigh hopper **122**. Thus the metering screw assembly conveys additive from the supply bin into a compartment of the weigh hopper.

Each of liquid containers **76, 78** is provided with a separate dispensing means **120**. Each liquid dispensing means is, for example, a variable-speed or displacement rotary or piston pump **79** (FIG. **2**). The liquid dispensing means pumps liquid additive from a container **76,78** through a flexible feed conduit which connects to a rigid dispensing tube end **120** (FIG. **5**) on the weigh subframe to deliver the additive into a liquid compartment **117–118** of weigh hopper **122**.

The hopper **122** (FIGS. **2, 4, 5,** and **7**) is carried by weigh subframe **34** between frame slats **41,43** below the open end of extension tube **108** of screw conveyor **80**. Hopper **122** is an elongated trough having a substantially semicylindrical cross section and a plurality of partitions **112** which divide the hopper transversely into several dry microingredient receiving compartments **113, 114, 115, 116**. Each of the dry compartments **113–116** is provided with a deflector **132** on its partition wall having a triangular cross section that directs additive concentrates to the interior of the compartments during both filling and emptying of the hopper.

Additional partitions **111** of hopper **122** cooperate with some partitions **112** and upper walls **128** to define liquid additive-receiving compartments **117, 118** having narrow openings **130** into which liquid dispensing tubes **120** direct liquid additives from containers **76, 78**.

The liquid and dry additive compartments of hopper **122** maintain dispensed additives separated until the hopper discharges its contents, after weighing, into the diluting liquid carrier within the mixing vessel **170** positioned vertically below the hopper.

Hopper **122** is supported by weigh frame **34** such that it is free to rotate about its longitudinal axis. Each semicircular end plate **134** (one being shown in FIG. **7**) of hopper **122** is secured to a shaft **136**. The shaft **136** at the hopper end shown in FIG. **7** is drivingly connected to a motor **138** that is fixed to hopper suspension frame **123** by a mounting bracket **273**. The shaft at the opposite end of the hopper is mounted in a bearing **140** (FIG. **4**). Motor **138** operates first to rotate hopper **122** to an inverted position for emptying (FIG. **11**); then to an upright position (in the same direction) for the next dispensing and weighing cycle.

An air flush means for compartments **113–116** of hopper **122** is shown in FIG. **11**. The air flush means is carried by the main frame and comprises a compressor **142** in fluid communication through passageway **144** with air pressure accumulator tank **146**. A solenoid valve **149** regulates the flow of air through passageway **148** to header **150**. The header in turn fluidly communicates with a plurality of hoses **152** that project into each compartment **113–116** of hopper **122** when the hopper is inverted. Each of hoses **152** is positioned to direct a stream of air against far wall **154** of the hopper. It is not necessary to direct the air stream against near wall **156** because that wall will have already been scraped relatively clean by the movement of dry additives against the wall and out of the hopper as hopper **122** rotates to an inverted position.

A vibrator motor **141** is carried by suspension frame **123** at the end of hopper **122** opposite hopper rotating motor **138**. Vibrator motor **141** operates during inversion of the hopper to promote emptying of the hopper compartments by vibrating the hopper.

An elongated mixing vessel **170** which serves as a receiving means for receiving additives from the hopper **122** and also as a mixing means for mixing such additives with water, is placed below hopper **122**. Vessel **170** is an elongated tub that is longer and wider than hopper **122**. Vessel **170** comprises a continuous, annular upright wall **172** around a sloping bottom formed from a plurality of triangular sections **176** that slope towards a pair of central bottom openings including an inlet port **177** and discharge port **178**.

Variable speed flow inducing means, such as variable two-speed mixers **180**, serve as part of the mixing means and are provided in mixing vessel **170** for inducing a turbulent flow of liquid within the mixing vessel. Each mixer **180** is comprised of four angled mixing blades **182** connected to the end of a rotary mixing shaft **184** that is connected to a gearbox **186** and motor **188** for rotating shaft **184**. Each of motors **188** is mounted on a motor mounting frame **190** along an outside face of vessel wall **172**. Level sensors **192, 194** are also mounted over the edges of wall **172** and project downwardly into the tub for determining the level of water contained therein and shutting off a supply of water to the tub when a predetermined level is reached. Sensors **192, 194** are, for example, electrodes through which an electrical circuit is completed or a timing circuit energized when the water surface in the tub reaches the predetermined level. Sensor **192** is the primary sensor, while sensor **194** is a backup sensor which detects a near overflow condition, closes fill solenoid **206**, and interrupts the fill cycle.

FIG. **10** shows a plumbing system for apparatus **10** which delivers and removes carrier and flush water from vessel **170**. Water is introduced from a source **195** by pump **193** through line **194** where its pressure is detected by pressure gauge **196**. Water then continues to flow through line **198** where it is divided by tee **200** into water lines **202, 204**. The flow of water through fill line **204** is controlled by solenoid valve **206** which, when open, allows water to flow through line **208**, thence to conduit **210** and into vessel **170** through port **177**. When solenoid valve **206** is open, a second solenoid valve **212** in line **202** remains closed such that all of the supply of water moves through line **204** to fill vessel **170**.

Solenoid valve **212** is interposed between line **202** and flush line **214** that in turn communicates with line **216** to establish fluid communication with conduit **210**. Line **214** also fluidly communicates with line **218** having branches **220, 222**. Branch **220** fluidly communicates with a pair of nozzles **224**, one positioned above blades **182** of each mixer **180**, nozzle **224** directing a flow of water onto the blades to clean them. Line **222** provides a passageway through which the water moves to flush ring **226** (FIGS. **9** and **10**) which is positioned around the upper inner periphery of vessel **170** adjacent its top edge. Ring **226** has a number of flush nozzles **228** which direct a flow of water downwardly against wall **172** of vessel **170** to flush it.

Apparatus **10** also has a delivery means for delivering slurry from vessel **170** to a receiving station for mixing with an animal feed ration at a location remote from the mixing vessel. This delivery means includes discharge opening **178** in fluid communication with conduit **240** that empties into discharge line **242**. Discharge pump **244** withdraws slurry through line **242** and sends it through line **246** to receiving station **248** where, typically, it is sprayed into a livestock feed ration and mixed therewith.

Weigh Means

A weighing means **250** (FIG. **6**) is provided on weigh frame **34** for weighing predetermined weights of the

different additive concentrates dispensed from bins **68–74** and containers **76, 78.** Weighing means **250** includes a weigh tower **252** extending vertically upward from a crossbeam **40** of weigh frame **34** midway between uprights **36** at each end of frame **34.** Each tower **252** has a flat top plate **254** with a central opening through which the threaded shank of an eye member **256** is placed and secured with a nut. A rubber pad **258** is placed against the interior face of plate **254** before member **256** is secured to top plate **254** with the nut. A pair of suspension members **260** pivotally interconnect eye member **256** and a second eye member **262** from which a load cell **264** is suspended. The amount of strain on load cell **264** is communicated to a control unit through line **265.** The load cell **264** in the preferred embodiment is capable of weighing to an accuracy of 0.5 grams.

A rubber isolator pad **266** is pivotally suspended beneath load cell **264** by suspension members **268.** A suspension arm **270** of the hopper suspension frame **123** is in turn suspended from isolation pad **266** by hook **272** and eye **274** secured to arm **270.** Arms **270** of suspension frames **123** thus suspend hopper **122** such that the entire weight of the hopper is freely suspended from load cells **264.** Arms **270** are braced by gussets **271** to their rectangular weigh frames **123.** Hopper **122** is suspended interior to frames **123** between slats **41, 43** of frame **34** by suspending shafts **136,** one of which is driven (FIG. **7**) and the other of which is mounted in a bearing **140** (FIG. **4**). The hopper is therefore free to rotate between frames **123** to an inverted position. This arrangement allows the weight of the hopper to be transferred through frames **123** to arms **270** for acting on load cells **264.** The weight of additive concentrates in hopper means **122** can therefore be accurately determined.

As best shown in FIG. **7,** a transverse vibration and sway dampening rod **276** extends between a bracket **278** carried by an upright of hopper suspension frame **123** and a bracket **279** carried by two longitudinal beams **37, 39** of weigh frame **34.** Such a rod **276** is provided at each end of weigh frame **34** adjacent face **134** of hopper **122** for preventing or damping transverse movements of the hopper. A similar longitudinal rod (not shown) extends along one longitudinal side of hopper **122** to prevent or dampen longitudinal vibratory or swaying movements of hopper **122,** one end of the longitudinal rod being fixed to longitudinal beam **39** and the other end being fixed to weigh frame **34.** Such sway dampening rods provide part of the means isolating the weight-sensitive components of the apparatus from movements that could affect accurate weight measurements.

Control Means

Apparatus **10** is provided with a control means, such as a central processing unit, for controlling the operation of apparatus **10.** In the preferred embodiment, two-programmed central processing units are used, one for operating the weighing functions of apparatus **10** and the other for operating all other machine functions.

Weighing Program

The logic of the program for operating the weighing functions of the machine is shown in FIG. **12.** The weighing CPU is activated by starting the menu at **280** and then entering ration data with keyboard **24** for a particular feedlot or data for one of a series of desired batches at a feedlot. The formulation of each desired batch has been preprogrammed into the computer such that a batch formulation can be chosen by entering a code number at **282.** The computer then searches at **284** for a match to this encoded formulation until the match is found and the machine is ready to batch. If a match is not found, the program at **285** returns to step **280** and a prompt is sent to screen **26** to enter ration data.

Once a match is found at **284,** a program prompt at **286** appears on screen **26** requesting the size of the batch to be prepared. After this information is entered, the program prompt at **287** requests the number of batches to be prepared, and if the batch size exceeds the capacity of the preprogrammed limit for the feed lot ration mixer or the compartments **113–118** of hopper **122,** this is computed at **288.** If capacity has been exceeded, a prompt is sent to screen **26** at box **289,** and the program will request that new data concerning batch size and number be entered by returning to step **286.** If capacity has not been exceeded, the machine is ready to batch at **290.**

The weighing computer first checks to determine if a weigh switch is on at **292,** and if the weigh switch is off, an alarm is sounded at step **293** and the program returns to ready at **290.** The alarm will alert an operator that the weighing switch must be turned on in order for batching to continue.

The program next calculates metering ration data at **294** and sends it to the machine operating program at **295** as indicated by A in FIGS. **12** and **13.** The metering data is calculated for any additives that have been selected for dispensing in the metering mode during the weigh cycle. Dispensing a portion of the additives by volume is more fully set forth in connection with steps **361–363** of FIG. **13** below.

The program then sets an output for the water level at **296,** the level of the water determining how much fluid carrier will be present in the slurry which is ultimately delivered to receiving station **248.** Water level information is sent to the machine operating program at **297,** as indicated by B in FIGS. **12** and **13.** The program next waits at **298** for a start signal which the operator gives by activating start switch **299** on switch panel **28.** The weighing cycle is then started at **300** by sending a start signal at **301** to the machine operating program as indicated by C in FIGS. **12** and **13.** Even though the weighing cycle has started, no weighing of microingredients actually commences until a signal is received back from the machine operating program at **302** as indicated by D in FIGS. **12** and **13** that indicates weighing should begin at **304.** This communication between the programs at D enables the machine operating program to begin its initial checks while microingredients are being dispensed and weighed.

Once the signal to begin weighing is received at **304,** the weighing sequence begins at **306.** It is first determined at **308** whether a motion sensor is detecting movement of hopper means **122.** Information is received from the motion sensor on the hopper at **309,** as indicated by E in FIGS. **12** and **13.** The program will not progress beyond **308** until the motion sensor indicates that hopper means **122** is not moving, since movement of the hopper means will adversely affect weight determinations of load cell **264.** Hopper means **122** can be put in motion by a variety of influences, such as wind gusts, floor vibration, personnel contact, or movement of machine parts. Although the effect of these movements on load cell **264** may not be great, the extreme accuracy required in dispensing microingredient feed

additive concentrates makes absence of movement desirable.

It is next determined at **310** whether the scale reading is less than 1000 grams. If the reading is greater than 1000 grams, it is probably because the hopper means is not empty, as indicated at **311**, and a signal is sent at **312**, **313** to dump hopper means **122** so that weighing of a new lot of microingredients can begin. The signal to dump is sent to the machine operating program as indicated at step **314** and F in FIGS. **12** and **13**. The mixers **182** are also started at **315** as indicated by G in FIGS. **12** and **13** so that the microingredients dumped from hopper means **122** will be mixed into a slurry and discharged to receiving station **248** in accordance with normal operation of the machine operating program described in connection with FIG. **13** below.

If the scale reading is less than 1000 grams, it is determined at **316** if the scale reads below zero. If that is the case, a message is given to the operator by **317** on screen **26** that the scale has failed and the supervisor should be called. Then at **318** the program prompts the operator to switch to a backup metering mode system which dispenses additive concentrates by volume instead of by weight, and a prompt is sent at **319** to screen **26** directing that the weigh switch **321** at panel **28** be turned off. The operator then performs as outlined in FIG. **15** by turning the meter switch on at step **500** and entering ration data at **502**. Volumetric metering of additive concentrates is performed by activating motor **102** of each bin **68–74** to rotate screw **90** for a predetermined period of time. Since screw **90** will dispense an approximate known amount of concentrate per unit of time, a volumetric approximation of the desired amount of concentrate can be dispensed without weighing.

If the scale reads above zero at **316**, the weighing mode of the program is instead used. Ingredient flow is started at **320** by activating motor **102** for screw **90** below bin **68**. Motor **102** has at least two speeds so that it initially operates at a higher speed during the initial phase of dispensing additive concentrates from bin **68** into a first compartment **113** of hopper means **122**. The weight of concentrate introduced into compartment **113** is sensed by load cell **264** and that information is continually fed back to the computer through line **265**. As the weight of concentrate dispensed from bin **68** approaches the predetermined amount of that concentrate for the batch formulation chosen at **282**, motor **122** is switched to a lower speed at **322** and **324** that more slowly dispenses the concentrate from bin **68** during a final phase of dispensing. In this manner, a more accurate weight of microingredient can be dispensed from bin **68** into compartment **113** since the dispensing of additive will have slowed before it is finally stopped when the correct weight of this first concentrate is sensed at **326**.

The program contains a weight compensation step at **328**. It sometimes happens that the actual weight of additive concentrate dispensed by dispensing means **80** into compartment **113** will be slightly greater or less than the desired weight set by the ration data at **282**. The program compensates for such inaccuracies by adding or subtracting a weight compensation factor to the ration amount set for the additive concentrate at **282**. In this manner, the weight inaccuracy will be corrected the next time a microingredient additive is dispensed from bin **68** into compartment **113**.

When the predetermined weight of microingredient additive concentrate is sensed at **326** and the weighing of that component has been completed, the computer determines if the just dispensed concentrate was the last microingredient dispensed at **330**. Assuming the microingredient concentrate in bin **68** was not the only concentrate to be dispensed in this formulation, the program then returns to box **320**, and the flow of ingredients from bin **70** is initiated by activating motor **102** beneath bin **70** to turn screw **90** at a fast speed and begin moving microingredient additive from bin **70** into compartment **114** of hopper means **122**. Load cell **264** continues to sense the weight of concentrate added to hopper means **122** from bin **70** until that weight begins to approach the final predetermined weight desired of the second concentrate. This predetermined weight will be the total actual net weights of the first additive concentrate plus the predetermined weight of the second additive concentrate since hopper means **122** has not yet inverted and the first additive concentrate still remains in compartment **113**. As the total combined actual weight of additive concentrate in compartments **113**, **114** approaches the predetermined amount, motor **102** is switched to a slower speed, and additive concentrate is continued to be slowly dispensed with screw **90** from bin **70** until the total combined weight of additive concentrate is reached, and motor **120** is shut off.

This same procedure is repeated until the predetermined weight of additive from each of bins **72**, **74** is similarly dispensed into compartments **115**, **116**. Liquid microingredient additive concentrates from containers **76** and **78** are dispensed by activation of a liquid pump which sequentially dispenses liquid additive from containers **76**, **78** into liquid receiving compartments **117**, **118** of hopper means **122** until a predetermined amount of each liquid additive has been dispensed.

Once the last additive has been dispensed, as determined at **330**, the computer determines that weighing has been completed at **332**, which sends at **334** a signal to the machine sequence program as indicated by H in FIGS. **12** and **13**. The computer pauses at **336** to wait on discharge of hopper means **122**. Once dumping of hopper means **122** has been completed by inversion of the hopper and its return to an upright position, this information is sent from the machine operating program of FIG. **13** to the weighing program of FIG. **12** as shown at I and **338**. It is then determined at **340** whether another batch of microingredient is required. If not, the program returns from **342** to its starting point at **280**. If another batch is required, the program returns to box **292** and the sequence repeats itself as described above.

Although not shown in FIG. **12**, the weigh program can be modified to keep a running inventory of additive concentrates. This can be accomplished by enterng into the weigh computer the weight of additive concentrate placed in each of bins **68–74** and containers **76**, **78**. The weight of each concentrate actually dispensed and sensed by load cells **264** is then subtracted from the original weight of concentrate to determine the inventory of concentrate remaining.

The control means can also be programmed to perform other functions that enhance the accuracy of weight determinations by the weighing means. For example, the isolating means can include programming the control means to prevent acceptance of the measured weight by the control means following operation of dispensing means **80** until motion of hopper means **122** sensed by motion sensors has subsided to a level that will not affect load cells **264**. The same result can be achieved by programming the control means to delay

operation of all other movable machine components (such as dispensing means **80**, **120** or mixers **182**) for a predetermined period of time sufficient for hopper **122** to settle or until any oscillatory movements subside. Alternatively, the isolating means can include programming the control means to prevent operation of moving components (such as dispensing means **80**, **120** or mixers **182**) while weight determinations are being made by the load cells **264**.

Machine Sequence Program

FIG. **13** schematically illustrates the logic of a program for actuating the sequence of operations of apparatus **10**. The program begins by determining at **344** if the weigh switch on switch panel **28** has been turned on. Once the weigh switch is on, the program is ready for a metering data signal at **345**. It waits at **346** until the metering ration data is received at **346** from steps **347** and **295** as indicated by A.

Once the metering data is received, the program is ready to batch at **348**. It receives water level data at **349** from **350** and **297** as indicated by B. The start signal from **301** is then relayed via C to **351** and **352**. The machine cycle is then started at **353**, and initiation of the cycle is signaled to the weighing program from **354** through D to **302**.

Boost pump **193** is then turned on at **355** for introducing water through line **194** in FIG. **10** with solenoid **206** open and solenoid **212** closed. It is determined at step **355** if the boost pump is on, and if it is not, an alarm is sounded at **356** that the pump is switched off. Boost pump **193** introduces water through line **208**, conduit **210**, and port **177** until a predetermined water level set at **294** is sensed by level probe **192**. If the predetermined water level is not reached within a set period of time as indicated by **357**, an alarm sounds at **358** to indicate that an error has occurred. Otherwise, if mixing vessel **170** fills within the set time, this condition is detected by level probe **192** and mixing blade motors **188** are activated at **359** on a slow speed to cause the water in mixing vessel **170** to flow. If the motors **188** do not turn on, an alarm is given at **360** to alert the operator of this malfunction.

It is possible to accurately dispense some liquid microingredient additives such as those in containers **74**, **76** by volumetric metering instead of weighing. Such accurate volumetric metering is possible since the density of most liquids is quite constant over the range of environmental conditions in which apparatus **10** is used. Volumetric metering of liquid additives selected by the metering ration data is achieved at **361** by activating the piston pump in dispensing means **120** for a period of time determined by **362**, **363**. Once the metering step is completed, the dumping mechanism is enabled at **364** for proceeding to weigh complete step **365** before inverting hopper **122**.

The program waits at step **365** for the weighing sequence shown in FIG. **12** step **320** through step **334** to be complete. Once the weighing sequence is completed at step **334**, a signal is sent to **365** through **366** at H from the weigh program, and the sequence program progresses to **367** where a signal is given at **368** from **314** via F to actuate motor **138** and invert hopper means **122** to dispense the additive concentrates contained in compartments **113–118** separately but simultaneously into the flowing water of vessel **170**. The dumping mechanism is disabled at **369** once the hopper leaves its upright position. Once hopper means **122** is inverted at **370**, vibrators on the hopper are activated at step **372** to promote complete removal of all microingredient particles from bins **113–118**. Compressor **142** is next actuated at **373** to compress air in air tank **146**, and a solenoid to header **150** is opened which moves a flow of air through hoses **152** and toward wall **154** of each of compartments **113–116** to remove any traces of solid additive concentrates from the compartments. Air flushing continues for a predetermined period of time at step **373**.

Hopper means **122** is then sent to its home position at step **374** by activating hopper motor **138** to continue to turn shaft **136** in the same direction it turned to invert the hopper. When the hopper returns to its upright position, this is sensed by a switch as indicated by step **375**, and a signal is sent at **376**, **377** to **338** through I that the contents of hopper means **122** have been dumped, and another weigh cycle (FIG. **12**) can begin. Meanwhile the machine operating program of FIG. **13** progresses to step **378** which switches motors **188** of mixers **180** to a higher speed. The lower motor speed is used until hopper means **122** leaves its inverted position since high speed mixing while the hopper is inverted could cause water drops to be splashed into containers **113–116**. Step **378** also begins to measure a preselected mixing time expires, as determined at **380**, the mixing motors **188** are switched back to their lower speed. Once the weighing program receives a discharge signal at **381** from step **315** through G and **382**, or alternatively from actuation of a discharge switch **383** on switch panel **28**, a discharge signal is sent by the program at **384** to discharge the slurry in vessel **170**. A solenoid valve in line **240** then opens, and pump **244** (FIG. **10**) is activated to remove the slurry through outlet **178** in vessel **170**. Mixer blades **182** continue turning at a slow speed until a predetermined period of time expires, as set by step **385**. Pump **244** continues operating as the water level lowers and finally clears the bottom of probe **192**, as illustrated by step **386**. If the level probe is not cleared within a predetermined period of time, an alarm is given at **387** to indicate a pumping malfunction.

After the water level clears the bottom of probe **192**, pump **244** continues operating and a timed flush cycle begins at **388**. Boost pump **193** is activated at **389** for introducing water through line **194** as solenoid **206** is closed and solenoid **212** is opened. In this manner, flush water is introduced through line **214** so that it enters vessel **170** through nozzles **228** of flush ring **226**, blade flush nozzles **224**, and port **177**. The interior of vessel **170** and the surfaces of blades **182** are thereby flushed, completely removing any residue of microingredient additives from the vessel through inlet **179**. The boost pump continues introducing a water flush into vessel **170** until the flush time period expires at **390**, and the flush is terminated at **391**. Discharge pump **244** continues pumping for a delay period following the end of the flush cycle, as shown at **392**; then discharge pump **244** is turned off at **393**.

The program then determines if the weigh switch is still on at **394** and if it is, the program returns to step **344** to repeat the sequence described in steps **344–393**. If the weigh switch has been turned off, the apparatus **10** is turned off at **395** and an alarm is given at **396** to indicate that a mode change has been made.

The control means includes means for operating mixers **180** and discharge pump **244** at the same time as dispensing means **80** such that a first batch of additive concentrate slurry can be mixed and delivered to a

receiving station while a second batch of additive concentrates are dispensed and weighed prior to their deposit into the mixing vessel.

Electrical Schematic

A schematic diagram of the electrical connections for apparatus **10** is shown in FIG. **14**.

It is important to the proper operation of a computer that it be supplied with electrical power of a constant and consistent quality. This is a serious drawback in rural areas where the electrical power being supplied is often at the end of a long supply line into which fluctuations are introduced by intervening power users. Most cattle yards and other users of apparatus **10** are located in rural areas where variations in power would adversely affect operation of the computers which control weighing and sequencing of machine function. For that reason, the present invention employs a series of transformers to selectively filter the electrical energy, isolate the power source, and damp variations in the power before it is supplied to the computers.

Four hundred eighty volts of power are supplied at **400** by a rural electrical utility, and that power first passes through 10 kw isolation transformer **402** where it is transformed into 240 V power, illustrated by **404** in FIG. **14**. This initially filtered 240 V power is supplied to electrical connection line **405** through relay **406** to booster pump **193** that introduces water into mixing tank **170** during the filling and flushing cycles. The 240 V power is also supplied through relay **407** to pump **244** that helps drain the mixing tank. This relatively unfiltered power can be supplied to pumps **193**, **244** since they are not as sensitive to power variations as the computers.

The 240 V power is also sent to a sola-regulating transformer **408** where it is transformed to 120 V power, as illustrated at **409**. This filtered, 120 V power is used to provide electrical energy to all components of apparatus **10** other than pumps **195**, **244**. If electrical energy is interrupted, three 12 V batteries **410** connected in series are provided as an uninterruptable power supply through triple power supply **412**.

Remote control unit **20** has monitor screens **26**, **29** and keyboards **24**, **27** for weighing and metering functions. Remote control unit **20** is electrically connected through line **422** with a weigh microcomputer **424** (RCA 1800 Micro System Z80 Microprocessor) having a 120 V optically isolated input/output relay board **426**. Remote control unit **20** is also connected through line **428** with machine sequencing microcomputer **430** (RCA 1800 Micro System Z80 Microprocessor) having an optically isolated input/output relay board **432** (Opto PB 24Q). Computer interface **434** provides a data bus between weigh microcomputer **24** and machine sequencing computer **430**.

Machine sequencing computer **430** and weigh computer **434** are supplied with 5 V power from triple power supply **412** through line **411**. Both I/O boards **426**, **432** are supplied with 120 V power through line **436** at **438**.

Weigh computer **424** contains an eight slot card cage with three 662 RAM memory cards that contain the programs for operation of the weighing functions and monitoring of microingredient additive inventory. Weigh computer **424** also contains a service box **641** card to connect the service box to the computer, a printer **641** output card, a 600 system operating program card, and a 6264 memory card.

The machine computer **430** has a six slot card cage, including two 662 RAM memory cards, as well as a 659, 650, 641 and 600 CPU card. When apparatus **10** is functioning in the metering mode, it uses only machine computer **430**. A complete set of ration data is stored on the machine computer's ROM memory separate from the ration data stored on the RAM memory cards of weigh computer **424**.

I/O board **426** is connected through line **448** with a speed control **444** for controlling the speed of dispensing means **80** in the weigh mode during a weigh cycle. For additives dispensed in weigh mode, speed control **444** determines whether screw **90** rotates at a fast speed during the initial weighing period of a given concentrate, or at a slow speed during the terminal phase of weighing as the weight of the concentrate approaches its predetermined amount. Since it is necessary to sense the weight of each concentrate that has been dispensed before the speed of dispensing means **80** can be reduced and then stopped, load cells **264** are electronically connected through scale head **418** to the weigh microcomputer **424**. Weight determinations of the weighing means can therefore be sensed and sent to speed control **444**. For additives dispensed by volume during a weigh cycle, speed control **444** determines that screw **90** rotates at the preset third speed during the predetermined time of volumetric dispensing controlled by micro computer **430**.

I/O board **432** is connected through line **446** with speed control **444** for controlling the speed of dispensing means **80**. Speed control **444** determines that screw **90** rotates at the preset metering speed on the third speed of speed control **444** for a predetermined amount of time of volumetric dispensing controlled by microcomputer **430**.

Input/Output board **432** is connected through line **440** with ingredient level controls **442** in each of bins **68–74** and containers **76**, **78**. These level controls are conventional switches located within the bins and containers for sensing when the level of additive concentrate in each bin has reached a predetermined low level. When the low level of additive concentrate is sensed by low level control **42**, a signal is sent to the operator indicating that more concentrate should be added.

I/O board **432** of machine sequencing microcomputer **430** is connected through line **450** and relay **452** with hopper rotation motor **138** that inverts hopper means **122**. Line **456** connects I/O board **432** through relay **458** with vibrator **141** on hopper means **122**. A switch **462** is also provided on hopper means **122** for sensing whether the hopper is in an upright or inverted position, switch **462** being connected to I/O board **432** through line **464**. Finally, hopper means **122** is provided with hopper air flush solenoid valve **466** in header **150** for controlling the introduction of air flush into compartments **113–116** of the hopper after it reaches its inverted position. Solenoid valve **466** is connected to I/O board **432** through line **468**.

Mixer motors **188** on mixing vessel **170** are connected through relay **470** and line **472** with I/O board **432**. Level control **192** of the mixing vessel is connected with I/O board **432** through line **474**. Solenoid valve **212** in flush line **202** is connected to I/O board **432** through line **476**, and solenoid **206** in fill line **204** is connected to I/O board **432** through line **478**. Booster pump **195** for pumping water into vessel **170** is connected through relay **406** and line **480** with I/O board **432**, while pump **244** for withdrawing slurry and flush

water from vessel **170** is connected through relay **407** and line **482** with I/O board **432**. Low water control **484** for the water supply is connected through line **485** with the I/O board. Motion and panel control sensors **486**, which detect any oscillatory movements of hopper means **122** and determine if any of the panels **12** have been removed from apparatus **10**, are interconnected with I/O board **432** through line **490**.

Metering Mode Program

As earlier described in connection with FIG. **12**, in the event of scale failure at step **317**, apparatus **10** switches to a meter mode at **318** and the weigh switch is turned off at **319**. The off position of the weigh switch at **319** is sensed as the meter switch being on at step **500** in FIG. **15**. The numeral 1 is entered at keyboard **24** at step **502** to begin batching in the metering mode, and a ration code name is entered at **504**. The metering mode program of FIG. **15** searches at **506** for a ration corresponding to the code entered at **504**. If the corresponding ration is not found at **506**, the program returns at **508** to step **504** so that another ration name can be entered.

Once the entered code has been matched with a ration at **506**, the program prompts for entry of information concerning batch size, which is entered at **509**. The program next prompts for entry of information concerning the number of batches to be processed, which is entered at **510**. The machine is then ready to batch at **512** by volumetric metering instead of by weighing.

The program waits at step **514** for a start signal **516**, which is supplied by a start switch **299** on control panel **28**. It is then determined at **518** if boost pump **193** is on, and if it is not, an alarm is given at **520** to indicate that the pump is off. Boost pump **193** fills mixing vessel **170** during a predetermined amount of time at step **522**. If the water level in mixing vessel **170**, as detected by water level sensor **192**, does not reach a predetermined level within a set period of time, an alarm sounds at **524** to indicate a filling error.

Once level sensor **192** determines that the water level in mixing vessel **170** has reached a predetermined level, mixing motors **188** are activated at **526** to rotate mixing blades **182** at a slow speed. An alarm sounds at step **528** if the mixers are not on. While mixer blades **182** induce a turbulent flow of water in mixing vessel **170**, motor **102** for screw **90** below bin **68** is activated at **530**. The metering speed of motor **102** is a third speed, intermediate the fast and slow speeds used in dispensing additive concentrates by weight. Screw **90** turns for a predetermined period of time sufficient to dispense a required volume of additive concentrate. The screw of each dispensing means **80** below the bin containing desired additive concentrates turn simultaneously. Dispensing means **120** for liquid additive concentrates in containers **76**, **78** also operate simultaneously with dispensing means **80** to volumetrically deliver predetermined amounts of liquid concentrate to compartments **117**, **118**.

When metering is complete at **532**, a signal is sent to motor **138** at step **534** to invert hopper means **122** and dump its contents into the flowing water of vessel **170**. A switch determines at **536** whether the hopper is inverted, and if it is not, an alarm is given at **538** to indicate a dump failure. Hopper vibrators are then actuated at **540** while hopper means **122** is inverted to remove, by vibration, additive concentrate particles that remain stuck to the walls or bottom of containers **113–116**. The air flush (FIG. **11**) is actuated at **542**, and the program sends a signal at **544** to send the hopper to its home, upright position by actuating motor **138** to continue rotation of shaft **136**. If hopper means **122** does not reach its home, upright position within a predetermined period of time set by **546**, an alarm sounds at **548** to indicate that a malfunction has occurred and the hopper is still inverted.

When hopper means **122** leaves its inverted position, mixing motors **188** are switched to their second, higher speed at **548**. High speed mixing continues for a predetermined amount of time and then returns to low speed at step **550** until a discharge signal **554** is received at **552** from a discharge switch **383** on panel **28** to turn on discharge pump **244**. It is determined at **556** whether discharge pump **244** is on, and if it is not, an alarm is given at **558** to indicate a pump malfunction.

A predetermined, mix delay time period is initiated at **558** during which period motors **188** continue to move mixing blades **182** at low speed. If the bottom of level probe **192** is not cleared at **560** within the predetermined period of time set in step **558**, an alarm is given at **562** to indicate pumping problems. Once probe **192** has been cleared, a predetermined flush cycle time is initiated at **564**, and boost pump **193** is actuated at **566** to move water through flush line **214** while solenoid **212** is open and solenoid **206** is closed. Boost pump **193** continues introducing water through line **214** and into flush ring **226**, blade cleaning nozzles **224**, and port **177** until a flush period has expired at **568** and pump **193** is turned off at **570**. Discharge pump **244** continues operating for a period of time set by **572** until all of the flush water residue has been removed through drain **178** and sent to receiving station **248**. Discharge pump **244** is then turned off at **574** when the delay period set at step **572** expires.

The metering mode program then determines whether another batch is needed at **576**, the need for another batch having been determined by the number of batches entered at **310**. If another batch is not needed, the program returns to step **502** which prompts the operator to enter the code for another batch. If, on the other hand, another batch is required at **576**, the program checks at **578** to determine if the meter switch is still on. If the metering switch is on (and conversely the weigh switch is off), the program returns to step **512** where it repeats steps **512–576**. If it is determined at **578** that the meter switch is off, apparatus **10** is turned off at **580** and an alarm is given at **582** indicating a mode change.

FIG. **16** Embodiment

FIG. **16** shows a second embodiment of apparatus **10** in which hopper means **122** has been eliminated. In this embodiment, the weight of each microingredient concentrate dispensed is determined on a "loss of weight" basis. Each of dry concentrate bins **600**, **602**, **604**, **606** is provided with a load cell **608** for determining the weight of each container. The program in this embodiment activates a dispensing means **610** (similar to dispensing means **80** in apparatus **10**) to selectively sequentially or simultaneously deliver dry microingredients separately from bins **600–606** into mixing vessel **612** having mixers **614**, **616**. Tank **612** is filled and flushed through water supply line **618** and emptied through discharge line **620** after concentrates have been mixed with water in mixing vessel **612**.

Liquid microingredient concentrates may also be dispensed on a "loss of weight" basis by mounting containers of liquid microingredient on load cells.

The control means for the FIG. 16 embodiment includes a means for controlling the dispensing rate of each dispensing means **610** in response to loss of weight sensings of load cell **608** for each bin **600–606**. Such a control means is similar to speed control **444** for dispensing means **80** in FIG. **14**.

In a variation of the embodiment of FIG. **16**, the control means includes a means for operating dispensing means **510** for several cycles in the volumetric metering mode wherein additives are dispensed using a weight per unit time formula instead of load cell **608**. The actual weight of each additive concentrate dispensed will be determined by the loss of weight measured by each load cell **608**. The actual weight of concentrate lost will be compared by the computer to the theoretical amount dispensed. The discrepancy between the actual and theoretical amounts will then be corrected by adjusting the formula to dispense more accurately the desired amount of additive concentrate. Since the remaining concentrate in each bin has substantially the same density as that already dispensed, the remaining additive can be dispensed accurately by volume.

Correction of the weight per unit time formula used for volumetric dispensing in the metering mode can be used in connection with any embodiment employing a weighing means. For example, volumetric metering into hopper means **122** of FIG. **2** can be adjusted by comparing actual weights of additive concentrate dispensed into compartments **113–116** with the desired amounts determined on a weight per unit time formula. The computer can then correct the formula to account for the density and other properties of the particular batch of additive concentrate being dispensed.

Alternatively, dispensing means **80** can be operated in a weigh mode from the beginning through a major portion of a dispensing cycle for a particular additive concentrate. The load cell **264** monitors the weight of concentrate dispensed at a given speed of screw **90**. This information is used by the control means to prepare a weight per unit time formula for volumetric dispensing of the particular additive being dispensed. The dispensing means **80** is then operated in a volumetric metering mode independently of the weighing means for the final portion of the dispensing cycle.

FIG. 17 Embodiment

Yet another embodiment of the invention is shown in FIG. **17** which takes advantage of the fact that the density of liquid microingredient concentrates does not vary as greatly as solid microingredients. For this reason, it is possible to accurately meter liquid microingredients by volume while measuring the solid microingredients by weight. In the embodiment of FIG. **17**, four dry microingredient containing supply means **701, 702, 704, 708** are shown to each be connected to a dispensing means **710** similar to the dispensing means **80** of apparatus **10**. Each of dispensing means **710** conveys dry additive concentrate to a hopper means **712** similar to hopper means **122** in FIG. **5**, the hopper means **712** being suspended from a pair of weigh cells. Each additive concentrate is dispensed sequentially into hopper means **712** from containers **701, 702, 704, 708** using dispensing means **710** until a predetermined weight of each concentrate has been sensed by a load cell from which hopper means **712** is suspended. Hopper means **712** is then inverted to separately and simultaneously empty the dry microingredient contents of hopper means **712** into flowing water in mixing vessel **714** which is being agitated by mixers **716, 718**.

In the FIG. **17** embodiment, liquid microingredients are separately stored in containers **720, 722** which are provided with tubes **724** that empty into vessel **714**. Rotary of piston pumps **728** are interposed in each tube **724** to pump microingredients from containers **720, 722** directly into mixing vessel **714**, thereby bypassing entirely hopper means **712**.

The control means for the FIG. **17** embodiment may, in some embodiments, include means for selectively operating some dispensing means simultaneously and others sequentially. Pumps **728** for the liquid additive concentrates in containers **720, 722** may, for example, be operated simultaneously with each other and with dispensing means **710**. Dispensing means **710** for dry additives should, however, be operated sequentially in this embodiment since the overall weight of hopper means **712** is sensed by the load cells from which the hopper is suspended. If the dry additives were dispensed simultaneously into hopper means **712**, it would not be possible to weigh accurately the amount of each additive dispensed. It is through cumulative weight determinations of sequentially dispensed additives that accurate weight determinations are made in the compartmented hopper. A first additive concentrate is delivered into a compartment of the hopper until its load cells register a first predetermined weight, and delivery of the first additive concentrate is stopped. Delivery of a second additive concentrate is then started and continued until the load cells register a second predetermined weight, and so on until predetermined weights of all selected additives have been delivered into the hopper.

In yet other embodiments which are not shown in the drawings, the control means is programmed to operate the dispensing means in an interrupted, on-off-on-off sequence to dispense selected microingredients into a weighing means such as hopper **122**. Weight determinations sensed by load cells **264** would only be accepted when the dispensing means is switched off during the interrupted sequence. In this manner, weighing inaccuracies caused by movement of the dispensing means or settling of additives would not affect weight determinations.

In another disclosed embodiment, the isolating means includes programming the control means to prevent operation of any other moving components of apparatus **10** while weight determinations are being made by the weighing means. The operation of dispensing means **80** and mixer blades **182** would, for example, be prevented by the control means while weight determinations were being made by load cell **264**.

FIG. 18 Embodiment

FIG. **18** shows an apparatus indicated generally at **800** in accordance with the invention and somewhat similar to the embodiment of FIGS. **1–15** but having two separate weigh hoppers **802, 803** for weighing the multiple additive concentrates dispensed from additive concentrate storage means **805, 806** by dispenser means **808**. The weigh means of the apparatus **800** includes separate weigh means for each weigh hopper **802, 803**, thereby giving the apparatus the capability of weighing multiple additives simultaneously in different weigh hoppers. This capability gives the apparatus **800** an advantage over the apparatus of FIG. **1** in being able to

dispense, weigh and discharge all of the multiple microingredients of a given formulation into the mixing vessel **810** and thereby complete the batching of a formulation, more quickly than the apparatus of FIG. **1**.

The apparatus **800** also includes a support frame means **812** which may include either separate support and weigh frames as in the apparatus of FIG. **1** or a common support frame for all of the major mechanical components of the apparatus as depicted schematically in FIG. **18**. Support frame **812** rigidly supports the multiple microingredient concentrate storage containers **805**, **806** and their associated dispensers or metering devices **808**, **809**. The support frame means **812** also rigidly supports the mixing vessel **810** which is shown as a mixing vessel common to both weigh hopper **802** and weigh hopper **803**.

Other major components of the system of FIG. **18** include control and other components which would normally be mounted apart from support frame means **812**, including a pair of scale heads **814**, **815**, one for each weigh hopper, a weigh computer or central processing unit **817** with its associated input/output board **818**, and a remote control unit or terminal **820** for controlling the operation of the computer **817**. A separate machine computer or central processing unit **822** has an associated input/out board **823**. An interface **824** enables communication between the machine computer **822** and the weigh computer **817**. Scale heads **814**, **815** transmit weight determination data through line **826** to the input/output board of the weigh computer **817**. There is also a printer **828** connected to the input/output board of weigh computer **817** through line **830** for printing desired output data from the weigh computer **817**.

In the apparatus **800** there are four microingredient additive concentrate storage containers **805** associated with weigh hopper **802** and another four such storage containers **806** associated with the other weigh hopper **803**, thereby giving each weigh hopper the capability of weighing and discharging four different additives into the mixing vessel **810**. The dispensers **808** associated with the different additive storage containers **805** are capable of operating independently of one another upon an appropriate command signal from a weigh computer **817** transmitted from the input/output board **818** through line **832**. Similarly, each of the dispensers **809** for the four other storage containers **806** are capable of operating independently of one another to dispense additives into the weigh hopper **803** upon a suitable command signal from weigh hopper **817** transmitted from input/output board **818** through line **834**.

Weigh hopper **802** is mounted at its opposite ends on a pair of load cells **836**, **837** connected by suspension members **838**, **839** and a pair of resilient isolator members **840**, **841** to support frame **812**.

Weigh hopper **803** is mounted in a similar manner by load cells **842**, **843** to support frame **812**. Thus, each weigh hopper is independently mounted by separate weigh means to the frame **812** for independent weighing of ingredients. The two load cells **836**, **837** for weigh hopper **802** are operatively connected by a line **845** to scale head **815**. Weigh hopper **803** is separately connected by a line **846** to a separate scale head **814**. Both of the scale heads in turn are connected to the input-/output board **818** of weigh computer **817** through line **826**. Thus each weigh hopper and its contents can be weighed separately and its contents cumulatively through its associated scale head simultaneously with the other weigh hopper. That is, both weigh hoppers can carry out their weighing functions at the same time and independently of one another.

Each weigh hopper **802**, **803** is preferably similar in construction to the weigh hopper disclosed in FIGS. **2**, **3**, **5**, **6** and **7**. That is, each weigh hopper is mounted in a manner shown in such prior figures for rotation from its normal additive receiving upright position to an inverted discharge position by discharge means including an electric motor **848** in the case of weigh hopper **802** and electric motor **849** in the case of weigh hopper **803**. Each is connected independently to the input/output board **823** of the machine computer **822** through suitable electrical conductors **850** and **851**, respectively.

Each weigh hopper, **802**, **803** also is provided with a motion sensor **853**, **854**, respectively, connected to the input output board **818** of weigh computer **817** through line **856** for detecting any motion in either weigh hopper during the weighing process. The software for the weigh computer **817** prevents a final weight determination from being made for a given weigh hopper whenever the motion sensor for that hopper senses motion that might give a false or highly inaccurate reading.

The support frame means **812** for the weighing and delivery components of the apparatus is preferably enclosed by housing panels (not shown) in a manner similar to that shown in FIG. **1** to shield and isolate the weighing components of the apparatus from external ambient forces that could cause undesirable motion and thus inaccurate weight readings. Such forces typically might include the effects of wind or jarring of the components by direct contact of personnel. The support frame means **812** is provided with a sensor **858** which is also connected by line **856** to the input/output board of weigh computer **817**. Sensor **858** is operable to prevent a weight determination from being made whenever a panel is removed from the support frame **812**. Thus the motion sensors **853**, **854** for the weigh hoppers and the panel sensor **858** for support frame **812** provide additional means for isolating the weighing components of the apparatus from influences that could affect weight determinations and the accuracies of such determinations.

A further means of enhancing the accuracy of the weight determinations of the apparatus disclosed in FIG. **18** is the mounting of the discharge motors **848** and **849** in conjunction with their respective weigh hoppers **802**, **803** so that such motors become part of the tare weight of the hoppers in making additive weight determinations. Because very lightweight, flexible electrical conductors can connect such electric motors to the operable control components of the apparatus, such conductors will have no appreciable effect on the weight determinations of the weigh means. This should be contrasted with the hydraulically actuated discharge means in conjunction with the weigh hoppers of prior apparatus. With a prior hydraulically actuated discharge means, relatively stiff hydraulic conduit must connect the hydraulic motor associated with the hopper to the source of hydraulic fluid remote from the hopper. Typically such hydraulic conduit affects weight determinations of the hopper in such instances because it inherently provides some structural support for the hopper, thereby influencing load cell weight sensings as ingredients are added to the hopper because the conduit is partially supporting some of the load of the added weight.

The apparatus in FIG. **18** also includes positive mixing means within the mixing vessel **810** in the form of a pair of mixing blades **860**, **861**, each driven by an electric motor **862**, **863**. The mixer motors are connected by electrical conductor means **864** to the input/output board **823** of the machine computer **822**. A slurry discharge line **866** leads from a bottom opening of mixing vessel **810** to the input side of a discharge pump **868**. The discharge line continues at **870** from the discharge side of discharge pump **868** to a conventional feed mixer such as typically the truck-mounted feed mixer **872**. A booster pump **874** pumps a liquid carrier such as water from a source (not shown) through a fill line **876** into the mixing vessel. A solenoid operated valve **878** in fill line **876** controls the admission of the water carrier into the mixing vessel and is operated by the machine computer **822** through a suitable conductor **878** connected to the input/output board **823** of such computer.

A flush line **880** branches from fill line **876** downstream of booster pump **874** and upstream of fill valve **874**. Another solenoid actuated valve **882** in the flush line connected to the input/output board **823** of machine computer **822** through conductor **884**, controls the admission of flush fluid into the mixing vessel.

The hardware components of the control system including the weigh computer **817**, machine computer **823** and their associated input/output boards, the printer **828**, and the remote control unit **820**, may be similar to those same units described with respect to the embodiment of FIG. **1**. Similarly, the software controlling the operation of such computers can be varied to vary the operating sequence of the machine of FIG. **18**.

A typical operating sequence of the machine of the apparatus of FIG. **18** is as follows:

A driver drives a feedtruck into a feed-receiving station in a cattle feedlot. The driver departs his vehicle, approaches the remote control unit **820** and selects the formulation of feed additive concentrates to be batched and delivered into his truck, depending on the specific lot of animals to be fed within the feedlot. The formulation is selected typically by the operator depressing a key corresponding to the formulation selected on the computer terminal of the remote control unit.

Assuming that predetermined weights of two additives A1, A2 in storage containers **805** and two additives A5, A6 from storage containers **806** are to be included in the formulation, the dispenser **808** for container A1 begins to dispense the additive A1 into weigh hopper **802**. At the same time, the dispenser **809** for container A5 begins to dispense additive A5 into weigh hopper **803**. The dispensing of additive A1 into weigh hopper **802** continues until a predetermined weight of such additive has been added to such hopper as determined by the load cells **836**, **837** and the associated scale head **815**, at which point the weigh computer **817** stops the dispensing of additive A1 from its storage container by stopping its associated dispensing means **808**. At the same time, a weight determination of the additive A5 added to weigh hopper **803** is determined in the same manner, but independently of the weight determination occuring in hopper **802**.

When the predetermined weight of additive A1 has been added to weigh hopper **802**, depending on programming, two alternative functions can occur. Either the weigh hopper **802** can be inverted by motor **848** to discharge the additive A1 into the mixing vessel **810** and then returned to its upright position to receive the next additive A2, or the weigh hopper can remain in its upright position while the dispenser **808** for additive A2 operates to add, cumulatively, the predetermined weight of additive A2 to weigh hopper **802**. If the latter sequence is used, weigh hopper **802** is inverted by its discharge motor **848** to discharge the predetermined weights of additive A1 and additive A2 together into the mixing vessel **810**. The same options are available with respect to the addition of additives A5 and A6 to weigh hopper **803** and the discharge of the contents of the weigh hopper **803** into the mixing vessel **810**. It is important to note that both weigh hoppers **802** and **803** can operate entirely independently to weigh and discharge their preselected additives into the mixing vessel **810**, although the machine and weigh computers could also be programmed to cause both weigh hoppers **802**, **803** to wait until all of the selected additives have been added and weighed within each weigh hopper and then both weigh hoppers inverted simultaneously by their respective motors to discharge all of the weighed additives at once into the mixing vessel. That is, each additive can be added, weighed and discharged either separately or cumulatively with other additives, depending on the programming selected for the control system.

Regardless of which of the above described dispensing, weighing and discharge options are selected, preferably booster pump **874** pumps the carrier water through open valve **874** and fill line **876** to fill the mixing vessel **810** to a predetermined level before any additive is discharged into the mixing vessel. This will prevent different and possibly incompatible additives from intermixing in concentrated form and also prevent additives from sticking to the inside walls of the vessel, making it difficult to remove such additives even after carrier water or flush water is added to the vessel.

Also preferably before the discharge of any additives into the mixing vessel in making up a batch, mixing blades **860**, **861** rotate to create a turbulent flow within the mixing vessel so that additives entering the liquid carrier are quickly intermixed with and dispersed throughout the carrier, thereby diluting the concentrates.

When the predetermined weights of the selected additives A1, A2, A5 and A6 all have been weighed in their respective weigh hoppers **802**, **803** and discharged into the water carrier within mixing vessel **810**, mixing blades **860**, **861** continue to rotate for a time to ensure a uniform dispersal of all additives throughout the carrier liquid slurry thus formed. Of course at this time, booster pump **874** shuts off and fill line valve **874** closes, as does flush line valve **882**.

When mixing is complete within mixing vessel **810**, discharge pump P2 operates to pump the slurry formulation from the mixing vessel through discharge line **866** and to the waiting feed mixer truck **872** through discharge line **870**. When the level of slurry within the mixing vessel drops below a predetermined level as determined by level sensors (not shown) within the vessel, booster pump **874** restarts and flush line valve **882** opens to pump flush water into the mixing vessel through its top and along its side walls to flush all slurry residue from the vessel. Flushing continues as the discharges of slurry proceeds through the discharge lines **866**, **870**. Discharge pump **868** continues to operate during the complete flush period, pumping the flush liquid with the slurry into the feed mixer truck **872**. After a predetermined length of time sufficient to enable the complete flushing of the mixing vessel and discharge lines, and the pumping of all slurry into the

feed mixer **872**, booster pump **874** stops and flush valve **882** closes. Pump **868** continues to operate until all of the slurry and most of the flush liquid is pumped into the feed mixer **872**. Thereafter the truck operator returns to his truck and drives away as the mixing of the feed and slurry continues. Typically, the driver drives to the feed bunks of selected pens or lots of animals and delivers the additive-bearing feed into the bunks immediately upon departure from the additive receiving station. Thereafter, typically, another feed mixer truck arrives at the additive receiving station represented by the position of truck **872** and that operator goes through the same procedure as just described, selecting the same or a different formulation depending on the requirements of the animals within the lot or pens that are to be fed with the feed ration from such truck.

During the additive formulating process as just described, the system will not allow a weight determination of a given additive to be made so long as a panel is removed from the support frame **812** as detected by sensor **858**. Nor will a weight determination be made if either one of the motion sensors **853**, **854** associated with each weigh hopper detects movement of a weigh hopper that could affect the weight determination to be made in such weigh hopper.

Typically, scale heads **814**, **815** receive weight sensings from their respective load cells 6 to 8 times per second. The scale heads then average such readings for that given unit of time and send the average reading via line **826** to the input/output board **818** of the weigh computer **817**. Computer **817** then records the averaged weight per unit of time as the weight upon which the computer acts to control the operation of the additive dispensing means and discharge means. Because of the large number of readings being averaged before the average is transmitted to the weigh computer, any single erroneous reading transmitted to a scale head by the load cells will have an insignificant effect on the accuracy of the averaged reading transmitted from the scale head to the weigh computer for processing. This slow updating of the weigh computer (about once per second or less) with an average of a large number of weight sensings received by the scale head is further insurance against inaccurate weight readings and enhances the accuracy of the entire system. If the computer updating were faster (such as twice per second or more), an erroneous reading would have a greater effect on the accuracy of weights recorded and processed by the computer.

FIG. 19 Embodiment

FIG. **19** is a flowchart of a computer program applicable to the computers of FIG. **14** and representing a modification of the program of FIG. **15** for operating the apparatus of, for example, FIG. **16** on a weight-compensated metering basis.

The flowchart of FIG. **19** incorporates steps **500–530** of the FIG. **15** program in box **900** and also the completion-of-metering step **532** of the same program. When all microingredients have been metered into the mixing vessel **612**, the program continues to sequence through steps **549–582** of the metering program of FIG. **15**, skipping steps **534–548** because the apparatus of FIG. **16**, unlike the apparatus of FIGS. **14** and **18**, does not use a weigh hopper.

As the program continues to sequence through mixing and discharge steps **549–582** as indicated at box **902** in FIG. **19**, the program also, at least after so many metering cycles, or if desired after every metering cycle, reads the weight of each microingredient storage container **600**, **602**, **604**, **606** as indicated at **904**. Thereafter, as indicated at box **906**, the program commands the computer to calculate the actual loss of weight of the ingredient storage containers to determine the actual weight of each microingredient metered, by subtracting the weight of each storage container sensed after metering at **904** from the initial weight of each storage container prior to such metering steps.

The program also commands the computer to calculate the theoretical weight loss of each storage container, which is also the theoretical weight of each ingredient used, by multiplying the metering rate of each metering device **610** in, for example, grams per minute, by the length of time each metering device **610** has operated, as indicated at box **908**. The program then commands the computer to compare the actual weight of ingredient used as calculated at **906** with the theoretical or target weight of ingredient used as calculated at **908**, as indicated at box **910**. From this comparison the program commands the computer to adjust either the time that each metering device **610** operates, or the rate of speed at which each such device operates, or both, during a metering cycle so that the actual weight of ingredient used as determined by weighing equals the desired or theoretical weight of ingredient used as determined by metering. This adjustment command occurs at box **912** in the computer program. When the metering speed or time adjustment is made, the program returns to the start of the metering cycle as indicated at box **900**.

The program also includes a fill mode or routine which is used whenever a microingredient storage bin **600**, **602**, **604**, **606** is refilled. In such mode, the program commands a reading of the initial weight of the storage container being refilled at box **914**. The additional microingredient is then added to the storage container as indicated in box **916**. The program then commands a reading of the filled weight of the storage container at box **918** and enters such weight in computer memory. At this point the fill subroutine has been completed and the apparatus is conditioned to start another metering cycle.

The foregoing described program operates the apparatus of FIG. **16** primarily as a metering apparatus. However, the metering devices **610** are adjusted after completion of a predetermined number of metering cycles based on actual loss-of-weight determinations of each storage bin as registered by the weighing means **608** for each storage container. Thus the apparatus of FIG. **16** when operated in accordance with the program of FIG. **19** is actually a hybrid weigh-metering system in which the metering components are periodically readjusted so that the theoretical or target weights of ingredients metered will closely approximate the actual weights of ingredients dispensed.

The described weight-compensated metering system can also be used in a continuous mill application in contrast to the batch mill application described with respect to FIG. **16**. In a continuous mill system, the metering devices meter the additive concentrates continuously at predetermined rates from their storage bins into a liquid carrier, which in turn flows into a feed ration at a predetermined rate. In such a system, weight losses of the storage bins can be determined periodically and then used to calculate the necessary adjustments of metering rates of the metering devices to bring the

actual weights of additives dispensed per unit of time by metering into line with the theoretical weights desired. This can be done without interruption of metering, simply by adjusting the speed controls or the metering devices.

Having illustrated and described the principles of the invention in several preferred embodiments, it should be apparent to those skilled in the art that the invention can be modified in arrangement and detail without departing from such principles. I claim all modifications coming within the spirit and scope of the following claims.

I claim:

1. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form, including multiple additives in liquid concentrate form and at least one of said multiple additives in solid particulate concentrate form;

dispensing a predetermined amount of said solid particulate concentrate by weight into a liquid carrier;

dispensing predetermined amounts of at least two selected said liquid additive concentrates into a liquid carrier by volume;

intermixing the additive concentrates in the liquid carrier, including both the solid particulate additive concentrate and the liquid additive concentrates, to dilute, disperse, and suspend them and form a liquid carrier-additive slurry;

after forming the slurry, directing the slurry to a receiving station while maintaining the suspension and dispersion of the additives until delivered into a feed ration.

2. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing selected said additives from their respective storage means into a weigh hopper means, weighing each selected additive in the weigh hopper means, and stopping the dispensing of each selected additive into the weigh hopper means when a predetermined weight of the selected additive is weighed;

discharging each selected additive from the weigh hopper means into a pool of liquid carrier after the additive has been weighed; and

positively intermixing the selected weighed additives with the pool of liquid carrier to disperse and suspend the additives in the pool to create an additive-carrier slurry; and

pumping the slurry into a feed ration and positively mixing the slurry with the feed ration before delivering the feed ration to the livestock for consumption.

3. The method of claim 2 wherein the pool contains a predetermined volume of liquid carrier.

4. The method of claim 2 wherein the pool is in a receiving tank beneath the weigh hopper means and the slurry is formed before being discharged from the receiving tank.

5. The method of claim 2 wherein the selected additives are cumulatively weighed in the weigh hopper means before any of the selected additives are discharged from the hopper means into the pool.

6. The method of claim 2 wherein at least some of the selected additives are cumulatively weighed in the weigh hopper means before being discharged from the hopper means into the pool.

7. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing predetermined weights of selected said additive concentrates from their storage means and depositing the selected additives after weighing into a liquid carrier;

intermixing the selected additives in the liquid carrier to dilute, disperse and suspend them and form a liquid carrier-additive slurry;

directing the slurry into a feed ration;

the step of dispensing predetermined weights including weighing multiple additive concentrates simultaneously.

8. The method of claim 7 including weighing multiple additive concentrates simultaneously by measuring the loss-of-weight of their respective storage means as the additive concentrates are dispensed from said storage means.

9. The method of claim 7 including weighing multiple additive concentrates simultaneously by measuring the loss-of-weight of their respective storage means as the additive concentrates are dispensed from said storage means.

10. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form, including multiple additives in liquid concentrate form;

dispensing predetermined amounts of at least two selected said liquid additive concentrates by weight into a liquid carrier;

intermixing the additive concentrates in the liquid carrier to dilute, disperse and suspend them in the carrier;

directing the additive-carrier mixture into a feed ration and intermixing the mixture and the feed ration.

11. The method of claim 10 wherein the multiple additives include both multiple liquid additives and multiple dry additives in concentrate form and wherein both the selected multiple liquid additives and at least one selected said dry additive are dispensed by weight into the liquid carrier and are intermixed therein.

12. The method of claim 10 wherein the multiple liquid additives are dispensed by weight by weighing them in a weighing container means after they are dispensed from their storage means and before they are discharged into the liquid carrier.

13. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form, including at least one said additive in liquid concentrate form and at least one said additive in solid particulate concentrate form;

dispensing a predetermined amount of said solid particulate concentrate by weight into a liquid carrier;

dispensing a predetermined amount of said liquid additive concentrate by weight into said liquid carrier;

intermixing the liquid and dry additive concentrates in the liquid carrier to dilute, disperse and suspend them and form a liquid carrier-additive slurry;

directing the slurry to a receiving station while maintaining the suspension and dispersion of the additives until delivered into a feed ration.

14. The method of claim **13** wherein the at least one dry particulate additive concentrate and the at least one liquid additive concentrate are cumulatively weighed in a weigh hopper means before they are discharged from the weigh hopper means into said liquid carrier.

15. The method of claim **13** wherein the at least one dry particulate additive concentrate and the at least one liquid additive concentrate are weighed in a common weigh hopper.

16. The method of claim **13** including weighing at least two selected said dry particulate additive concentrates and at least two liquid additive concentrates.

17. The method of claim **16** wherein the selected additive concentrates are cumulatively weighed before being discharged into the liquid carrier.

18. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing predetermined amounts of selected said multiple additive concentrates by weight into a liquid carrier;

intermixing the weighed additive concentrates in the liquid carrier to dilute, disperse, and suspend them and form a liquid carrier-additive slurry;

directing the slurry to a receiving station while maintaining the suspension and dispersion of the additives until delivered into a feed ration;

the step of dispensing a predetermined amounts of said multiple additive concentrates by weight includes weighing each selected said additive concentrate to the nearest one gram.

19. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing selected said additives from their respective storage means into a weigh hopper means, weighing each selected additive in the weigh hopper means, and stopping the dispensing of each selected additive into the weigh hopper means when a predetermined weight of the selected additive is received in the weigh hopper means;

discharging each selected and weighed additive from the weigh hopper means into a liquid carrier;

intermixing the selected weighed additives in the liquid carrier to disperse and suspend them in the carrier to create an additive-carrier slurry;

pumping the slurry into a feed ration and positively mixing the slurry with the feed ration before delivering the feed ration to the livestock for consumption;

the step of weighing each selected additive in the weigh hopper means including weighing at least some of the selected additives cumulatively in the weigh hopper means before discharging the cumulatively weighed additives into the liquid carrier.

20. An apparatus for dispensing and delivering microingredient feed additives into a livestock feed ration at a livestock feedlot shortly before delivering the feed ration to the livestock for consumption, the apparatus comprising:

multiple storage means for storing separately multiple said additives in concentrate form;

dispensing means for dispensing selected said additives from their respective said storage means;

a weigh hopper for receiving additives dispensed from said storage means by said dispensing means and weighing the dispensed additives;

receiving tank means for receiving a liquid carrier from a source of said liquid carrier and for receiving additives discharged from said weigh hopper after they have been weighed;

pumping means for pumping additive bearing liquid carrier from the receiving tank to a receiving station for delivery into a livestock feed ration;

said weigh hopper being partitioned into separate container portions, each separate container portion being positioned to receive a different said additive dispensed by said dispensing means.

21. The apparatus of claim **20** wherein said weigh hopper includes at least one container portion for receiving a liquid additive, said storage means includes at least one liquid storage container for storing a liquid additive in concentrate form, and said dispensing means includes at least one liquid dispensing means for dispensing liquid additive from said liquid storage container into the liquid container portion of said weigh hopper.

22. The apparatus of claim **20** including means for rotating said weigh hopper from an upright position for receiving additives dispensed by said dispensing means to an upside down position for discharging additives weighed in said weigh hopper into said receiving tank means.

23. Apparatus for dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, the apparatus comprising:

multiple storage means for storing separately multiple said additives in concentrate form;

dispensing means for dispensing selected said additives separately from their respective storage means;

weighing means for weighing the amounts of selected additives dispensed by said dispensing means and stopping the dispensing means for the selected additives when predetermined weights of said selected additives are weighed by said weighing means;

receiving tank means for receiving the predetermined weighed amounts of the selected additives dispensed from said storage means by said dispensing means and weighed by said weighing means and for receiving a liquid carrier from a source of said carrier;

pumping means for pumping additive-bearing liquid carrier from said receiving tank to a receiving station for delivery into a feed ration;

metering means for operating said dispensing means to meter additives from their respective storage means on a volumetric weight-per-unit-of-time basis;

and control means for selectively disabling said weighing means and enabling said metering means.

24. Apparatus according to claim 23 wherein said control means is operable normally to operate said dispensing means in a weigh mode and is operable upon malfunction of said weigh means to operate said dispensing means in a volumetric mode.

25. Apparatus for dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, the apparatus comprising:

multiple storage means for storing separately multiple said additives in concentrate form;

dispensing means for dispensing selected said additives separately from their respective storage means;

weighing means for weighing predetermined amounts of the selected additives dispensed by the dispensing means and stopping the dispensing means when predetermined weights of the selected additives are dispensed;

receiving tank means for receiving a liquid carrier from a source of liquid carrier and for receiving the weighed amounts of said selected additives;

pumping means for pumping additive-bearing liquid carrier from said receiving tank means to a receiving station for delivery into a feed ration;

said weighing means including means for weighing said multiple storage means and determining the weights of selected said additives dispensed by determining the loss of weight of the respective storage means for the selected additives.

26. An apparatus for dispensing and delivering microingredient feed additives into a livestock feed ration at a livestock feedlot shortly before delivering the feed ration to the livestock for consumption, the apparatus comprising:

multiple storage means for storing separately multiple said additives in concentrate form;

dispensing means for dispensing selected said additives from their respective said storage means;

a weigh hopper for receiving additives dispensed from said storage means by said dispensing means and weighing the dispensed additives;

receiving tank means for receiving a liquid carrier from a source of liquid carrier and for receiving weighed additives discharge from said weigh hopper;

pumping means for pumping additive-bearing liquid carrier from the receiving tank to a receiving station for delivery into a livestock feed ration;

and means for rotating the weigh hopper from an upright position for receiving additives from the dispensing means to an upside down position for discharging weighed additives into the receiving tank means.

27. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing predetermined weights of selected said additive concentrates into a liquid carrier;

directing the liquid carrier containing the dispensed feed additives to a receiving station for delivery into the feed ration; and

determining the predetermined weights by weighing at least some of the selected additive concentrates dispensed within weighing container means, and after said some concentrates are weighed, discharging them simultaneously into the liquid carrier.

28. The method of claim 27 wherein the some selected additive concentrates are dispensed and weighed cumulatively within weighing container means comprising a single container.

29. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing predetermined weights of selected said additive concentrates into a liquid carrier;

directing the liquid carrier containing the dispensed selected additive concentrates to a receiving station while maintaining the additive concentrates in suspension in the liquid carrier until the carrier is delivered into a feed ration; and

determining the predetermined weights of the different selected additive concentrates dispensed by measuring the loss of weight of the additive storage source for each additive concentrate dispensed.

30. An apparatus for measuring, dispensing, and delivering microingredient feed additive concentrates in small but accurate amounts in a liquid carrier into a livestock or poultry feed ration shortly before the delivery of the feed ration to the animals for consumption, said apparatus comprising:

multiple storage means for storing separately a plurality of different microingredient feed additive concentrates;

multiple dispensing means for dispensing separately several additive concentrates from said multiple storage means;

weighing means for determining the weights of said different additive concentrates dispensed;

isolating means for isolating said weighing means from influences affecting the weighing function of said weighing means so that accurate weight determinations are obtained;

control means for controlling separately the operation of said plural dispensing means in response to weight determinations of said weighing means to control the weights of additive concentrates dispensed;

receiving means for receiving additive concentrates dispensed from said storage means and for receiving a liquid carrier for suspending the concentrates dispensed and carrying said concentrates to a destination;

delivery means for delivering the liquid carrier containing the additive concentrates dispensed to a receiving station for mixing with a feed ration;

a support frame for supporting the weighing means;

said weighing means including a weigh hopper for receiving additive concentrates dispensed by said dispensing means and at least a pair of load cells mounting said weigh hopper to said support frame;

hopper discharge means for discharging weighed additive concentrates from the weigh hopper into the receiving means;

said isolating means including resilient vibration dampening means between said weigh hopper and said load cells, electrically operated said discharge means on said weigh hopper and supplied with electrical power from a power source remote from the weigh hopper through flexible electrical conductor means, and panel means enclosing the support frame to isolate the support frame and the weigh means from ambient influences that might otherwise affect weight determinations.

31. A method of dispensing and delivering formulations of microingredient feed additives into a livestock feed ration at a feedlot shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form, including some of said additives in dry concentrate form and at least one additive in liquid form;

weighing predetermined amounts of selected said additives including at least two said additives in dry concentrate form, with no substantial intermixing of the selected additives during the weighing process;

discharging the weighed amounts of the selected additives in dry concentrate form into a mixing vessel;

introducing a liquid carrier into the mixing vessel;

intermixing the liquid carrier and weighed amounts of selected additives in dry form in the mixing vessel to form a slurry within the mixing vessel; and

conveying the slurry to a receiving station while maintaining the weighed amounts of additive concentrates in dry form in suspension and dispersion until the slurry is delivered into the feed ration.

32. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form, including multiple additives in liquid concentrate form;

dispensing predetermined amount of at least two selected said liquid additive concentrates by weight into a liquid carrier;

directing the additive-bearing carrier into a feed ration and intermixing the additive-bearing carrier and the feed ration.

33. The method of claim 32 wherein the multiple additives include both multiple liquid additives and multiple dry additives in concentrate form and wherein both the selected multiple liquid additives and at least one selected said dry additive are dispensed by weight into the liquid carrier.

34. The method of claim 32 wherein the multiple liquid additives are dispensed by weight by weighing them in a weighing container means after they are dispensed from their storage means and before they are discharged into the liquid carrier.

35. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form, including at least one said additive in liquid concentrate form and at least one said additive in solid particulate concentrate form;

dispensing a predetermined amount of said solid particulate concentrate by weight into a liquid carrier;

dispensing a predetermined amount of said liquid additive concentrate by weight into said liquid carrier;

directing the carrier bearing the liquid and dry additives dispensed to a receiving station for delivery into a feed ration.

36. The method of claim 35 wherein the at least one dry particulate additive concentrate and the at least one liquid additive concentrate are cumulatively weighed in a weigh hopper means before they are discharged from the weigh hopper means into said liquid carrier.

37. The method of claim 35 wherein the at least one dry particulate additive concentrate and the at least one liquid additive concentrate are weighed in a common weigh hopper.

38. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, comprising the steps:

storing separately multiple said additives in concentrate form;

dispensing predetermined weights of selected said additive concentrates from their storage means and depositing the selected additives after weighing into a liquid carrier;

delivering the carrier bearing the diluted additive concentrates into a feed ration;

the step of dispensing predetermined weights including weighing multiple additive concentrates simultaneously.

39. A method of dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to livestock for consumption, comprising the steps:

storing multiple said additives in concentrate form in separate storage containers;

dispensing volumetrically from their separate storage containers predetermined amounts of selected said additives by operating a separate dispensing device for each selected additive at a predetermined dispensing rate for a predetermined period of time;

calculating the theoretical weight of each said selected additive dispensed at said predetermined rate and for said predetermined period of time;

determining the actual weight of each selected additive dispensed at said predetermined rate and period of time;

comparing the theoretical and actual weights of each selected additive dispensed and from the comparison calculating an adjustment for at least one of the predetermined dispensing rate and period of time for the associated dispensing device such that the theoretical weight will be substantially the same as the actual weight of additive dispensed upon continued operation of the dispensing device;

adjusting the dispensing device for each selected additive using the calculated adjustment for such dispensing device;

depositing each selected dispensed, and weighed additive into a liquid carrier and delivering the selected additives-bearing liquid carrier to a receiv-

ing station for intermixing with the livestock feed ration.

40. The method of claim 39 including determining the actual weight of each selected additive by measuring the loss-of-weight of the storage container for the selected additive.

41. The method of claim 39 including determining the actual weight of each selected additive by dispensing a selected additive from its storage container into a weigh hopper and weighing the selected additive in the weigh hopper.

42. The method of claim 39 including determining the actual weight of a selected additive in a weigh hopper and then discharging the weighed additive from the weigh hopper into the liquid carrier.

43. The method of claim 39 including dispensing each selected additive sequentially into a weigh hopper, determining the actual weight of each selected additive in the weigh hopper before dispensing sequentially the next selected additive into the weigh hopper.

44. The method of claim 39 wherein the steps of calculating the theoretical weight and determining the actual weight are performed using a computer.

45. The method of claim 44 wherein the steps of comparing the theoretical and actual weights of each selected additive dispensed and calculating the adjustment for the dispensing device for each selected additive dispensed are performed using a computer.

46. The method of claim 45 wherein the adjustment of the dispensing device for each selected additive is performed by a computer.

47. The method of claim 39 wherein the steps of calculating the theoretical weight, determining the actual weight, comparing the theoretical and actual weights, calculating an adjustment and adjusting the dispensing device for each selected additive are performed at least once for each said predetermined period of time a selected additive is dispensed volumetrically from its storage container.

48. The method of claim 39 wherein the steps of calculating the theoretical weight, determining the actual weight, comparing the theoretical and actual weights, calculating an adjustment and adjusting the dispensing device for each selected additive are performed selectively and not necessarily for every predetermined period of time a selected additive is dispensed volumetrically from its storage container.

49. The method of claim 39 wherein the steps of calculating the theoretical weight, determining the actual weight, comparing the theoretical and actual weights, calculating an adjustment, and adjusting the dispensing device for each selected additive are performed periodically as the selected additive is dispensed volumetrically from its separate storage container.

50. Apparatus for dispensing and delivering microingredient feed additives into a livestock feed ration shortly before delivering the feed ration to the livestock for consumption, the apparatus comprising:

multiple storage containers for storing separately multiple said additives in concentrate form;

dispensing devices, one for each storage container, for dispensing selected said additives separately from their respective storage containers;

weighing means for weighing the amounts of selected additives dispensed by said dispensing devices;

a receiving tank for receiving the selected additives dispensed from said storage containers by said dispensing devices and for receiving a liquid carrier from a source of said carrier;

a pump for pumping additive-bearing liquid carrier from said receiving tank to a receiving station for delivery into a feed ration; and

a programmable control for controlling the operation of the dispensing devices, the weighing means and the pump, the control being operable to:

(a) selectively operate the dispensing devices to meter selected additives from their respective storage containers on a volumetric weight-per-unit-of-time basis;

(b) selectively operate the weighing means to determine the actual weight of each additive dispensed volumetrically by its dispensing device;

(c) calculate the theoretical weight of each additive dispensed volumetrically by its dispensing device;

(d) compare the theoretical and actual weights of each additive dispensed volumetrically; and

(e) calculate an adjustment factor for the dispensing device for each additive dispensed based on the comparison of (d) such that upon adjustment of the dispensing device using such factor, the theoretical weight of additive dispensed volumetrically should be substantially the same as the actual weight of additive dispensed by the adjusted dispensing device.

51. The apparatus of claim 50 wherein the weigh means includes a weigh hopper into which a dispensing device dispenses additive volumetrically for subsequent weighing.

52. The apparatus of claim 50 wherein said weighing means includes means for measuring the loss-of-weight of each storage container.

53. The apparatus of claim 50 wherein said programmable control includes means for adjusting each dispensing device using the calculated adjustment factor.

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RELATED PROCEEDINGS APPENDIX

None